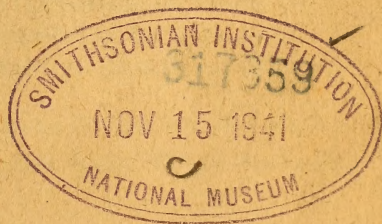


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PROCEEDINGS
OF THE
NATURAL HISTORY SOCIETY OF DUBLIN,
FOR THE
SESSIONS 1869-70, 1870-71.

VOLUME VI.—PART I.



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PROCEEDINGS

OF THE

NATURAL HISTORY SOCIETY OF DUBLIN.

SESSION 1869-70.

ANNUAL GENERAL MEETING, NOVEMBER 3, 1869.

ROYAL IRISH ACADEMY HOUSE, DAWSON-STREET.

RICHARD PALMER WILLIAMS, Esq., M.R.I.A., Vice-President, in
the Chair.

THE Minutes of the preceding Meeting, being those of the concluding Meeting of the Session, were read and confirmed.

The Ballot was then opened for the President, Vice-Presidents, Council, and Officers for the ensuing year. R. Roberts, Esq., and Thomas Kift, Esq., were appointed Scrutineers of the Ballot.

During the taking of the Ballot the following Resolutions were proposed and seconded and passed :—

Proposed by George Dixon, Esq., F.R.G.S.I. ; seconded by Rev.
Thaddeus O'Mahony :

“That William Archer, Esq., be requested to withdraw his resignation of the office of Joint Secretary of the Natural History Society.”

Proposed by Thomas Kift, Esq. ; seconded by Dr. A. H. Jacob :

“That the resignation of Dr. Wright as Joint Secretary of this Society be not accepted.”

The following Report from the outgoing Council was then read :—

“Your Council beg leave to report that during the last Session the following Papers have been read :—

ZOOLOGICAL.

“‘On a New Genus of Freshwater Rhizopoda, &c.,’ by William Archer, Esq.

“‘On *Acanthocystis Pertyana*,’ by William Archer, Esq.

“ ‘ On the Anatomy of *Lemur nigrifrons*,’ by John Barker, Esq., M.D.

“ ‘ On the Bony Dorsal Shield of *Tragulus Javanicus*,’ by John Barker, Esq., M.D.

“ ‘ On the Mucous Folds in the Stomach of a Lioness,’ by John Barker, Esq., M.D.

“ ‘ On some Points observed in the Anatomy of an Aylesbury duck,’ by Arthur Wynne Foot, Esq., M.D.

“ ‘ On *Euplectella aspergillum*,’ by S. R. Graves, Esq., M.P.

“ ‘ On the Comparative Anatomy of the Pronator Group of Muscles,’ by Dr. Alexander Macalister.

“ ‘ On *Tubipora musica*,’ by Professor E. Percival Wright, M.D.

“ ‘ On the Odonata of the Seychelles,’ by Professor E. Percival Wright, M.D.

“ ‘ On *Rhinodon typicus* and its Parasites,’ by Professor E. Percival Wright, M.D.

BOTANICAL.

“ ‘ On *Sphaeria Robertsii* from New Zealand,’ by Arthur Wynne Foot, M.D.

“ ‘ On the Flora of Kinross-shire,’ by Dr. Alexander Macalister.

“ ‘ On New Species of Diatoms from Arran,’ by Rev. Eugene O’Meara, A.M.

“ ‘ On the Discovery of *Cuscuta epithymum* in Ireland,’ by Dr. Walter G. Smith.

“ ‘ Notes of a Tour to Sicily and Portugal in the spring and autumn of 1868,’ by Professor E. Percival Wright, M.D.

“ Considerable delay has been incurred in the publication of Part II. of Volume V. of the ‘ Proceedings,’ owing, in a great measure to the difficulty of obtaining from the authors the manuscripts of the Papers read. Part III. of Volume V. is already nearly printed, and Part IV., concluding the volume, and containing the Papers enumerated above, is in progress. Seven of the ten plates required for the illustration of this Part are already printed. Mr. Archer, with his accustomed liberality, has defrayed the expense of the four coloured plates which illustrate his two communications. Your Council would take this opportunity of impressing upon their successors the great importance of publishing and illustrating their monthly proceedings.

“ During the past Session the Society has suffered the loss, by death, of two of its annual members—Dr. Maurice H. Collis and Mr. John Good. The latter gentleman was for several years a member of the Council, and a most regular attendant at its meetings, and was at all times ready to assist any of the members of the Society in Natural History pursuits. The records of the Society, and the fourth volume of Mr. Thompson’s ‘ Natural History of Ireland,’ bear witness to the number of species added to the Irish Fauna through Mr. Good’s exertions, and all who knew him will recollect how ready he was at all

times to subscribe towards any object having the advancement of the Natural History of Ireland in view.

"Towards the middle of the last Session your Council received a communication from the Committee of Science of the Royal Irish Academy to the effect that the Committee were anxious to devise some plan for the amalgamation under one head of all the scientific societies of Dublin. Your Council, in compliance with a request contained in the communication from the Committee, appointed their two Honorary Secretaries as delegates to attend a meeting specially convened for this purpose. The meeting was held at the Royal Irish Academy House on the 22nd of April, 1869, and at it a series of Resolutions, eleven in number, were drafted out and printed, in order that they might be submitted to the various societies for their consideration. These Resolutions were laid by the delegates before your Council on the 3rd of May, 1869, and a Resolution was passed to the effect that the Council recommend to the Society the acceptance of the proposals contained in the draft suggestions adopted at the meeting of the 22nd April. This Resolution of the Council and the draft suggestions were, by order of the Council, sent to all the members of the Society, and were also laid before the members at the ordinary monthly meeting on the 5th May. At this meeting it was resolved that the Society consider it for the present inexpedient to merge the existence of the Society in a biological section of the Academy. A Resolution was also passed at this meeting to the effect that the minute-book of the Council, containing the minutes of the Council meeting of the 3rd of May, be produced, and this although the Honorary Secretaries declared that the minutes in question had not as yet been written up, nor were they, until confirmed at the subsequent meeting, to be regarded as the authorized minutes of the Council meeting of the 3rd of May. In consequence of the passing of this Resolution, the Honorary Secretaries tendered their resignation of office, which was accepted, but at the request of the Council they consented to continue their services until the election of their successors in the following November.

"Your Council would also call attention to the fact that, by a Resolution of the Society, the night of meeting has been changed from the first Friday to the first Wednesday in the month.

"Having now mentioned the chief events of the past Session, or at least those seeming to call for special mention, it remains for your Council to surrender their trust into the hands of their successors. They would call their attention to the fact that they hand over to them a reserve fund in Consols equal to all the composition fees of all their Life Members, and of all the entrance fees paid within the last four years; they leave them a balance-sheet showing no debts due, but a sum of money to the credit side, beyond the amount to be paid for the two forthcoming Parts of the 'Journal,' and a Library consisting of some hundreds of volumes and parts of volumes, obtained by the exchange of the Journal of the Society, and costing the Society nothing but the expense of their carriage. With their term of office they complete the

fifth volume of the Proceedings of the Society, and they can speak with confidence as to the increase of scientific matter that has appeared from the first to the fifth of these volumes.

"In conclusion, your Council would suggest that the best thanks of the Society are due to the Royal Irish Academy for their kindness in granting the use of the room in which the Society meets, and for the light and fire with which they have been so liberally provided."

It was proposed by R. Roberts, Esq., and seconded by Joseph H. Woodworth, Esq.: "That the foregoing Report of the outgoing Council be adopted by the Society." This Resolution, having been put to the meeting, was declared carried.

The Treasurer (Arthur Andrews, Esq.) then submitted his Annual Report, showing an income received of £107 6s. 11d., an expenditure of £60 17s. 3d., and a balance in hands of £56 9s. 9d. This Report was received, and ordered to be audited by R. Roberts, Esq., and Joseph H. Woodworth, Esq.

The Scrutineers then reported the result of the Ballot as follows:—

PRESIDENT.—Lord Clermont.

VICE-PRESIDENTS.—William Andrews, M.R.I.A., F.R.G.S.I.; Robt. Callwell, M.R.I.A., V.P.R.G.S.I.; Alexander Carte, M.D., F.L.S., M.R.I.A.; Rev. Thaddeus O'Mahony, M.A., M.R.I.A.

COUNCIL.—Robert Ball, A.M.; Henry Malkin Barton; George Dixon, F.R.G.S.I.; Arthur Wynne Foot, M.D.; A. H. Jacob, M.D.; Thomas Kift; John J. Lalor, F.R.G.S.I.; Alexander Macalister, F.R.G.S.I.; David Moore, Ph.D., M.R.I.A.; Rev. Eugene O'Meara, A.M.; Joseph Todhunter; R. H. Traquair, M.D.; Henry Wilson, F.R.C.S.I.

HONORARY TREASURER.—Arthur Andrews.

HONORARY DIRECTOR OF MUSEUM.—Robert J. Montgomery, F.R.G.S.I.

HONORARY SECRETARIES.—William Archer and E. Perceval Wright, M.D.

The Chairman then adjourned the Society until the first Wednesday in December.

DECEMBER 1, 1869.

WILLIAM ANDREWS, Vice-President, in the Chair.

Mr. Andrews, on taking the Chair, observed that since the last meeting some changes had occurred in the Office-bearers of the Society. The Honorary Secretaries having resigned their office, the Council had appointed Dr. Macalister as Honorary Secretary, whom he now called upon to read the minutes.

The Minutes of the preceding Meeting having been read, compared, and signed,

ARTHUR WYNNE FOOT, M. D., Fellow of the King and Queen's College of Physicians, read the following Paper:—

NOTES ON IRISH LEPIDOPTERA.

THE specimens of Irish Lepidoptera which I shall have the honour of laying before the Society this evening, were obtained in the counties of Wickow and Kilkenny during the past summer. I feel that they do not deserve any attention on the grounds of variety or rarity; and the notes which I have made on the subject are hasty memoranda, frequently jotted down on the backs of my collecting boxes, while sheltering under a tree or bridge from a passing shower. To these field observations I have ventured to add some further remarks which suggested themselves in connexion with particular insects; and as they have reference to the specimens exhibited, I hope the Members of the Society will not consider them untimely or misplaced. I have always had the feeling that this Society is one which loves to have some of the nights of winter beguiled by the narration of field experiences of the more cheerful out-door times of spring, and summer, and autumn; and I think it to be a part of the duty of our Members to collect their observations in the longer days of the year for the entertainment, and perhaps the instruction, of one another in the longer nights of the year. But it is my opinion, be it right or wrong, that field experiences should be supplemented by reading the experience of others on the same subject, and I have endeavoured to combine with my few personal notes such information derived from books as may, some time or other, save others the time or trouble necessary to collect it if required. I hope to have some future opportunity, before the close of the Session, of bringing before the Society specimens of several of the other orders of insects which I have met with this year, but shall on the present occasion confine my remarks to the Lepidoptera.

In the early part of the past July (1869), I had occasion to spend some time in a part of the county Wicklow—the neighbourhood of Newcastle—which is very favourable to entomological pursuits. The wooded glens of Dunran and Ballyvolan, as well as the Glen of the Downs and the Devil's Glen, were within easy reach, the two former places quite close. My first anxiety was to get a series of the narrow-bordered bee hawk-moth, *Sesia bombiliformis*, which I knew was to be found in suitable localities in the county. Mr. More, and Mr. Carrington, of York, had just before I left town been very successful in obtaining this sphinx near Lough Dan—their captures are recorded in the "Entomologists' Monthly Magazine" for August, 1869, p. 67. On the 5th July I caught one at 1 p.m., on a gloomy day, wind S.W., hovering over the red blossoms of *Lychnis Flos-cuculi*, in a rushy meadow, full of rank herbage, bordered by a wood on one side, and by a stream on the other; from its dampness, and

the softness of its soil, the meadow has the local name of Chapel-river bog. In the same place I got four more on the 6th, between 3 and 4 P. M., and saw two or three more; the day was one of alternate sunshine and shade, the wind westerly. On the 8th I got three more, between 4 and 4½ P. M., wind south-west, showers and sunshine. After this date I saw no more of them, although I frequented the place almost every day in the afternoon hours. It was, I think, an unusual thing to obtain this sphinx so late in the season, but the uncommon backwardness of insects this year was most remarkable. May is the time given for its appearance in Stainton's Manual, and on this account I had but little hope of being able to get any specimens in July. It is impossible, of course, to say how long the specimens had been out; but they all appeared quite fresh when captured, as may be easily seen by looking at them now. I had also been under the impression that these moths were most likely to be found in the hottest sunshine, and in the brightest parts of the day; but I did not meet with one before 1 P. M., and their time of appearance was usually between 3 and 5 o'clock, P. M. They seemed to come from the adjacent plantation, in which there was a good deal of alder and fir, to the blossoms in the boggy meadow which attracted them, and to fly off towards the same place when they left the flowers.

On the 19th of July, I saw the first silver-washed fritillary (*A. paphia*). I had been on the look out for these butterflies from the 1st of the month, about which time they should be out in ordinary seasons. A fine series, male and female, of these beautiful insects was soon obtained, almost always taken over bramble blossoms. I met with but two tiger moths (*A. caja*) during the summer: one, which when I saw it was almost unrecognisable from its battered condition, had been found in a garden, in the early part of August, by a workwoman, who had kept it in her pocket the greater part of the day, which accounted for its appearance; the other was a very perfect insect, fresh from the chrysalis, which in the end of August came into a lighted room through an open window. It is a common matter of observation how comparatively seldom the tiger moth is found in the perfect condition, while the well-known hairy larva is so frequently met with both in spring and in autumn. The larvæ of the tiger moth may turn up in most unexpected places. In the early part of last June I found in the course of a week or ten days about eighteen of them, feeding upon dock and white nettle, in a small yard, not far from the centre of this city, enclosed by high walls and buildings; the enclosure is paved, but the docks, white nettle, crowfoot, and plantain have contrived to grow between the stones with great luxuriance; it is enclosed on two sides by the buildings of the Medical School of the University of Dublin, and by high walls on the other sides. It is not a spot which one would think likely to attract the female tiger moth to deposit her eggs in. I bred nine tigers from the larvæ, and several of them are as good specimens as are usually seen. There were no varieties among them, nor is this to be wondered at, since their circumstances as to light and food, while in the

breeding cages, were precisely similar for all; and I believe it is now held, and I think with much probability, that lepidopterous ornamentation is most affected by the degree and kind of light the larvæ are exposed to, and by the quantity and quality of the food plant they are obliged to use. In the locality in which I found *S. bombiliformis*, the Ringlet butterfly (*H. hyperanthus*) swarmed after the 8th of July, and it also occurred in the greatest profusion up to the end of that month in damp rank meadows, and rushy places in the vicinity of woods. Mr. Birchall, in his catalogue of Irish Lepidoptera ("Proc. Nat. Hist. Soc. Dubl.," vol. v., pt. i., p. 59) mentions this butterfly as rather local, and states that he had observed it in profusion near Galway, and in Malahide park.

On the 21st July, at 11½ a. m., I came upon two oak eggars (*Lasio-campa quercus*) fluttering across a roadway through a wooded glen; they were both males; I saw but one other of this species through the summer, not being fortunate enough to come across an "assembling," or nuptial gathering, of this insect, as was a friend of mine, who, driving in his gig near Rathfarnham, passed through a company of these moths in attendance on a female; he easily secured seven fine specimens. It is stated that the males of this moth will even go into the pocket of the collector, if a recently hatched female be enclosed in a box therein. The descent of twelve Wood Leopards (*Z. æsculi*) down Mr. Hewitson's drawing room chimney, in August last, may have been due to an "assemblage," although there was no female discovered among the lot.

From the middle of July I began to meet with the Humming-bird hawk moth (*Macroglossa stellatarum*), over bramble blossoms and honeysuckle, throughout the day from forenoon to evening. Although this moth is most commonly met with in the autumnal months (at least it is in September and October that I have caught most of them), it is well known that they may be obtained all through the year, the warmth of many of our winter days tempting them from their hibernating quarters. On this moth Mr. Birchall observes (*Op. cit.*, p. 61), "very common; seems to be on the wing day and night for the greater part of the year. It frequently comes to sugared flowers in the evening; and once, about midnight, it tapped for admission at the lantern of the Bailey Lighthouse, and was secured." The humming-bird moth was, according to my observations, very much less abundant during the past summer than in the previous one; and perhaps it may have been remarked that there did not appear to be the same number of letters, if any, on the subject in the newspapers, which invariably appear when the moth is abundant and seen by many for the first time. The humming-bird moths may be often noticed in the hotter summer months resting on garden walls with a southern aspect, and the cause of this habit has been discussed, in the Entomological Society of London. It has been suggested that it might result from a desire to enjoy the extra heat afforded by such walls, or that the *Gallium mollugo*, a favourite food plant which grows in such situations, attracts it; but the most received explanation is that the moth enters holes in sunny walls and banks to rest itself for

a while between its flights ("Ent. Monthly Magazine," vol. iii., pp. 216, 239). 12th August, saw *Cynthia cardui* (painted lady), for first time this year—four specimens, very fresh; these insects are proverbially uncertain in their appearance. I did not observe a tenth of the number of them I had seen in 1868. *Thecla quercus* (the purple hair streak), I found, but it was not common: one specimen I got in the rocky gorge of Glenmalure, near a plantation of young oaks.

The large Magpie Moth (*Abraxas grossulariata*) swarmed in lanes in the evenings (on one occasion a sweep of my net took in seven); the females were not unfrequently noticed in gardens in the daytime. The only object in collecting these was to try for varieties; but I was not successful in getting any striking ones.

I was continually on the look out for the large Tortoiseshell Butterfly (*Vanessa polychloris*), as a gentleman living near Newtownmountkennedy had told me they had occurred there. In August of 1866 he saw them in numbers, mixed with red admirals (*Vanessa atalanta*) about fine arbutus trees which grow before his house; he was not collecting at the time, but has since done so, and is certain there could have been no mistake; he writes to me—"It was in August of 1866 that the *large* tortoiseshells, mixed with the red admirals, were so plenty about our house. There was no mistake about them, for they were as large as the largest of the red admirals, and very much larger than the ordinary small tortoiseshells, which are always in numbers about here. I was not at the time collecting or I might easily have caught them to preserve. In '67 the red admirals were scarce, and we thought we saw one specimen of the large tortoiseshell. In '66 the large tortoiseshells and the red admirals, which were always mixed on the arbutus trees, remained with us for some weeks, but I don't recollect how long." Mr. Birchall puts a note of interrogation after the name of this insect as an Irish one, and says—"A specimen seen near Galway in 1861; but, as the insect was not captured, and has not been observed elsewhere, I insert it doubtfully."—(*Op. cit.*, p. 59).

In the county Kilkenny, on 28th of August, I saw thirteen *Colias edusa* (the clouded yellow butterfly) flying over clover fields, and along the embankment of the Waterford and Kilkenny railway, near where that line crosses the Nore. This was the first day for their appearance in that district. The day was very warm, wind S. E., a clear sky, and hot sun. I caught five out of the thirteen seen; and, as they were fresh, and therefore wild and strong on the wing, I earned and enjoyed exceedingly a double swim across the Nore. I soon discovered that in working such a place as a railway bank it is much better to wait in the course of the *Edusa*, as it flies up or down the line, than to hunt it; they seem, in most cases, to have a certain beat, regulated apparently by the amount of sunshine and shelter from the wind, and by the profusion of flowers; and up and down this course they go, whereas, if hunted unsuccessfully, they are apt to go straight off as fast and as far as they can from the disturbing cause. They do not mind a stroke at them being missed, if you do not follow it up with a chase,

and I noticed that one of them paid no attention to a train passing along the line, but kept wavering and dancing along till it fell into my net as I stood in its course. On the 30th I saw eight more *Colias edusa*, most of them flying along a country road, in the neighbourhood of which were several clover fields. Very often they went in off the road over stubbles; and when they did so, it was very difficult to keep them in sight, particularly if they were over oat stubble, as the yellow of the butterfly became confounded, on the one hand, with the light golden brown of the oat straw, and, on the other, with the ochreous colour of the dry baked clay; for there had been at this time an unusual dryness. 31st August, saw thirteen more *C. edusa*; the wind still E.; in this point it had been for a considerable time; there had been a frost the preceding night. September 1st was a cold, bleak, overclouded day, with a fresh breeze from E.; and, although there was a good deal of sunshine in the afternoon, no *Colias edusa* were seen. The 2nd September was a warm day, with very little wind, an air from the N.E. in the morning, which fell off before noon. I saw twenty-six *Edusæ* on this day; and a lady, who was perfectly acquainted with this butterfly, and who was driving in a neighbouring part of the county, but in an opposite direction to that in which I was working, saw ten. The following day, 3rd September, was overcast, though warm, wind S.W.; searched seven clover fields in the district in which I had seen so many the day before, but did not come across one. 4th September was a bright day, with passing clouds, warm, wind S.; saw ten *Edusæ*. The weather broke on the following day, and a series of gales from S. and W. came on, with heavy rains. The appearance of *C. edusa* in that particular district of the Co. Kilkenny, the neighbourhood of Thomastown, this year, was for one week, from 28th August to 4th September, inclusive. In those eight days I saw myself seventy, and a trustworthy observer saw ten others. Of the seventy seen I captured thirty-six; two of them were females, and only one of them was in the least torn or faded. I saw eight other specimens later in September, between the 20th and 27th; so that the gross number which I know to have been seen amounts to eighty-eight. In the same district, in 1868, at same period of the year, I neither saw nor heard of *Colias edusa* being seen; and a person capable of giving an opinion on the subject told me it was nearly ten years since they had noticed these "yellow butterflies" in that part of the county. I did not come on *C. Hyale*, though I had been warned by my friend, Mr. Kirby, that I might find it when *Edusa* is plentiful. On *Colias edusa* Mr. Birchall remarks:—"Common in some seasons on the south and east coast; occurs more rarely north of Dublin; in profusion at Killarney in August, 1865."—(*Op. cit.*, p. 58). Several observations on the occurrence of *Colias edusa* in Ireland have been laid before this Society—one by Mr. Williams was read 23rd January, 1857 ("Nat. Hist. Rev.," vol. iv., p. 70), recording the observations of Mr. Ussher on *Colias edusa* in Co. Waterford in autumn of 1855; another by Professor E. Perceval

Wright, December, 1865 ("Proc. Nat. Hist. Soc. of Dublin," vol. v., p. 7), placing on record three new Irish localities for this insect—Co. Dublin, Co. Down, and neighbourhood of Belfast, and giving much information on the geographical range of this insect; and another by Mr. Andrews, in January, 1866.—(*Op. cit.*, p. 20).

It has been observed that there are some Lepidopterous insects whose appearance in any considerable number in a given year is uncertain, while periodically there is an unusual abundance of them. Among those most subject to a periodic scarcity and plenty are, *Colias edusa* and *hyale*, *Sphinx convolvuli*, which, in the year 1846, was in England captured on the wing in hundreds (Stainton's *Man.*, vol. i., p. 82), *Cynthia cardui*, and *A. sancia* (the pearly underwing). The explanations that have been offered of this irregularity of appearance are, that the eggs or pupæ lie dormant until a favourable season occurs for their development; that if the weather be unusually severe at the usual time for the egg hatching, the development of most of the eggs will become latent, and they will wait over till a more favourable season, when there may be, in consequence, a double or treble brood; others think that the period of maximum mortality among young Lepidoptera is when they are small larvæ, having just left the egg, and that it is the occurrence of heavy rains at this time which causes the greatest diminution in their numbers.

Towards the end of September I took at sugar *Agrotis sancia* and *Agrotis lunigera* (the crescent dart); of the former, a dozen specimens, which exhibit a good deal of variation in their tints and markings. 4th September I was sent a fine larva of *Acherontia atropos* (death's head moth), almost full fed; it had been found in a garden among cabbages; it ate potato leaves voraciously till the 6th, when it left off feeding; its colours lost their brightness, and the skin over the anterior segments became puffed-up, giving it a bloated, dropsical appearance. I was continually watching the larva, and distinctly observed it working with its mandibles at the skin of the distended parts till it cut it, letting out a quantity of water, which removed the dropsical appearance, and notably reduced its bulk; the next day (7th September) it buried itself in clay, with which I had filled the bottom of a breeding cage; having eight days afterwards to disturb the clay, I found the large brown chrysalis in its capacious egg-shaped clay cocoon. Superstitious feelings with regard to this curious caterpillar prevent its being more frequently obtained. My friend, Mr. Graves, told me that it is to this day in the county Kilkenny called by the peasantry the murrain, from an impression that it gives cattle the murrain, by stinging them in the nose with the caudal horn; and the remedy they adopt is to take the larva and put it into a hole made in an ash tree, the hole they close up with a plug of wood. Mr. Graves saw this done in the county Kilkenny when he was a boy, years before the potato blight had come to this country, which misfortune has since been attributed also to this larva—perhaps from the larva feeding on the leaves of the potato and the chrysalis

being not unfrequently turned up in digging potatoes. Mr. Birchall observes the death's head moth is generally distributed in Ireland, but is not so abundant as might have been expected in the metropolis of the potato plant. (Catalogue, *Op. cit.*, p. 61.)

I take this opportunity, in exhibiting the chrysalis of the death's head moth, to show four very fine specimens of the perfect insect, with most of which some incident of interest is connected. One is an insect, nearly five inches in expanse of wings, taken this autumn in the county Cork, and sent up to Dublin alive; it lived without any food for nearly three weeks under a glass fern cap, the size of a hat; honey and sugar were placed near it, but it was not observed to touch them, probably it did so at night; it made a squeaking noise when handled; another is from Sligo, and was captured by the late Captain King; the third was taken on board a fishing boat, at a considerable distance from land, off the coast of Kerry. This great sphinx has on several occasions been taken far out at sea, as have several others of the larger Lepidoptera—for instance *S. convolvuli* has been taken 25 miles from shore, struggling in the water; *A. villica* has been taken on a boat fifteen miles out; *Brassica* and *Aglaia*, seven or eight miles from land ("Trans. Ent. Soc." N. S., vol. iii., Proc. p. 117). Mr. W. H. Flower exhibited to the Royal Zoological Society two specimens of a death's head moth, (*A. atropos*), taken on board the "Hotspur," East Indiaman, Captain H. Toynlee, on her homeward voyage, in lat. 40° 29' N., long. 15° 00' W., 260 miles from the coast of Portugal, after an easterly gale; also a specimen of *S. convolvuli*, ♀, which flew on board the same ship in lat. 12° 09' N., long. 21° 17' W.—the prevailing winds being westerly and northerly. ("P. Z. S. L.," 1866, p. 305). A passenger on board the steamship "Pera" (Oct. 12, 1860), about twelve miles east of Cape Bon, Africa, while sitting in the after part of the vessel, observed a "painted lady," which appeared to come from seaward, and readily overtook the steamer, which was then making 10½ knots an hour; the insect often soared high, and did not seem at all fatigued ("Zoologist," July, 1869, p. 1768). The fourth specimen of the death's head was taken out of a beehive under the following circumstances:—A gentleman in the county Kerry noticed that his bees were daily deserting one of their hives in numbers; they were seen in crowds on the ground about the hive, dead from cold and exposure to the autumnal dews. One night he and his gardener, anxious to find out what could be wrong inside the hive, lifted it off the stand, which was a safe operation, as hardly any bees remained in the hive, and they found a death's head inside it, quietly settled in a corner; it was sent up to me in a vesuvian box, for which it was rather a tight fit, with the query, "could it be a kind of queen bee?" Huber was the first who called attention to this propensity of the death's head to enter beehives; it is said to be attracted to these places by its love for honey; and the impunity with which it can venture into such places is explained by some as due to the hardness of its body, which is said to be impenetrable to the stings of the bees—

indeed, a pin requires to be pushed with force before it enters its body—while others think that it is by the sounds it makes that it overawes the bees. In the last number of the “Zoologist” (Nov. 1869), there is an interesting account by an experienced beemaster, the Rev. Charles Bury, M. A., of a raid made by this insect on one of his hives. On the 15th June he was “raising” one of his hives in the evening twilight, and while watching the movements of the bees, who were considerably excited by the disturbance, something so like a bat flitted round that it did not attract his particular notice; but shortly afterwards he saw what he could not fail to recognise as a death’s head moth flit backwards and forwards once or twice before the hive, dash at the entrance, penetrate the cluster of bees, and disappear within; he had only a small landing net at hand, and with this he waited anxiously close outside the hive, to intercept the intruder on its exit. In about five minutes out she came (for it proved to be a female), in no small bustle. He thought he could distinguish—for it was almost dark—five or six bees attached to her legs. Instead of taking wing, the moth scrambled fast enough over the cluster of bees about the door to the top of the hive, he put the net on her; but, as hundreds of bees were entangled in and about the meshes of the net, he could not seize the moth, which, after running round and round with marvellous celerity, escaped, and was off like a shot. Next evening he kept watch for her; she appeared, dashed against his study window, which was immediately over the hive, and he lost sight of her. On the 2nd October he found between the folds of a piece of carpeting which had been over the same hive all the summer to protect it from rain, a death’s head, the finest British specimen he had ever seen; and, as he had not seen one since June 16th, he suspected it was the same; that it descended every evening to feast in the hive, and then returned to its place of retreat within the folds of carpet. This moth, while in captivity, on being touched emitted sounds which could be distinguished by sharp ears. He had observed that while the moth was in the hive, sounds, best described as a rather musical squeak, appeared to come from the hive. Those given out by the moth while in captivity corresponded to these. This moth, although very seldom observed on the wing, may, in the proper season, be found in most unexpected places—for instance, on the arrival of the mail train at Dumfries station, on the evening of 27th September, 1868, one of the servants about the station noticed a large insect at rest on one of the carriages; it turned out to be a very fine specimen of *Acherontia atropos*, measuring over five inches across the wings—(“Ent. Monthly Magazine,” vol. v., p. 171). Mr. Andrews not long ago exhibited to this Society a specimen taken in an office in this city; and the insect has been found alive in the British Museum. A medical man has given me in writing his recollections of a strange adventure with a death’s head moth in an ominous situation, at the bedside of a patient. He was attending a lady in James’s-street, in this city, one afternoon in autumn, more than

twenty years ago. She was a very nervous person, and had taken a most gloomy view of her case. He was standing at a window opposite to the foot of the bed in which she lay, when he observed a large dark brown moth on the white bed curtains, which, on closer inspection, he found to be a beautiful specimen of the death's head moth, and which he still preserves. Knowing the patient's temperament, and the superstitious feelings entertained by some with regard to these moths, and at the same time anxious to secure his prize, he was obliged to exert some ingenuity to effect his purpose, which he succeeded in doing without being noticed. It is strange how circumstances of ill omen seem to gather round this insect, which is in all parts of the world regarded with fear and awe by the uneducated, and has been considered to be the herald of plague, famine, or some dire calamity. This moth is very generally distributed over the world; some very fine specimens of it from China and India are in the Entomological department of the Royal Dublin Society; but none of them exceed in size the Irish examples which I exhibit to the Society. In Japan it is very abundant in favourable seasons. Mr. G. Lewis, writing from Nagasaki, September, 1868, states he collected fifty of the larvæ in ten minutes from a small patch of *sesamum orientale*, and that it was equally common everywhere on the same plant—(“Ent. Monthly Mag.,” vol. v., p. 173).

The sounds made by the death's head moth, when frightened or hurt, are like a squeak or squeal, and have been compared to the cry of a mouse or weasel. When attempts are made to kill it with oxalic acid, the loud squeak uttered as soon as the poisoned needle pierces it, sounds very like a remonstrance; and the strange noise continues with unusual distinctness until the powerful acid has done its work—(“Ent. Monthly Mag.,” vol. v., p. 130). It loudly objects to the introduction of the bulb of a thermometer into the inside of its body to ascertain its temperature. One of these moths was captured in a loft at Bandon, Co. Cork (16th July, 1856), from having attracted attention by its cry, which was described as resembling that of a rat or weasel—(“Nat. Hist. Rev.,” vol. iv., p. 79). The loud “squeaking” of four of these moths, on their emergence from their pupal condition in the middle of the night, has awakened the persons sleeping in the room with them—(“Ent. Monthly Mag.,” vol. v., p. 147). It has also been observed that the insect is able to produce this sound before quitting the pupa case; even in the larval state it is said to be capable of making a noise. The caterpillar, if disturbed at all, draws back rapidly, making at the same time, according to some observers, a rather loud noise, which has been compared to the crack of an electric spark—(Kirby and Spence's “Entomology,” 7th ed., p. 492). I could not induce the larva of this moth to make any sound, although I gave it full provocation to complain if inclined to do so. The noise in the adult insect is made by both sexes, sometimes, as in the cicadæ, the power of producing sound is peculiar to the males of insects, whence Xenarchus extolled the fortune of those animals whose wives are

dumb. Its mechanism is not yet explained; a committee of French Lepidopterists ("An. de la Soc. Entom. de France," 1839), discussed and examined the explanations offered of it, and suggested some themselves, but the mystery has not yet been solved. The theories advanced to account for the noise are enumerated and combated in Westwood and Humphrey's "British Moths" (vol. i., p. 10, 1843).

A writer in the "Ent. Monthly Mag.," vol. v., p. 171, speaking of a death's head moth captured October, 1868, says it frequently emitted the sounds peculiar to its species, always raising the thorax, and bending down the head and abdomen as it did so. When breathing its last, it gave out a long succession of sounds, growing fainter and fainter, just like a succession of breathings, giving him the impression that the noise was produced, not mechanically by friction, but by inspiration or respiration of air. It made the noise when he first had it, every time he merely touched it with his finger; but when it got accustomed to such treatment, it never made it without rather rougher handling.

The sounds made by the death's head moth are strong or weak, according to the amount of vitality in the insect at the time; thus the cries of one caught two days, and which had been pierced with a pin, were noticed to be weak and faint, and seldom uttered. The sound is not made by voice, in the true sense of the word, but rather by some sound-producing instrument; so that sonorous insects are not songsters, but rather instrumental musicians. The buzzing of insects is not included in the term sonorous. The emission of sounds in insects is very interesting, as nearly all the class are mute. The subject has been very fully treated by M. Goureau in "An Essay on the Stridulation of Insects" ("Entomological Magazine," 1838, vol. v., pp. 89, 357).

The death's head moth is not the only lepidopterous insect capable of making a noise. It has been long known that one of the tiger moths (*Chelonia pudica*) found in France, produces an audible sound when flying in the evening. Dr. Laboulbene, an entomological anatomist of great repute, has investigated the cause of this sound, and has arrived at the conclusion that it is caused by the pressure of the posterior thighs upon certain tympaniform vesicles on each side of the pro-thorax. Sounds are also produced in the species of the genus *Setina*, which possess a highly developed vesicle, and the cause of the sound is considered to be the same as in *Chelonia pudica* ("Ent. Monthly Mag.," vol. ii., p. 70). *Basiana postica* (Port Natal) gives out sounds resembling those of a *Lamia* (a beetle of the longicorn family) for minutes together—"Brit. Mus. Cat. of Lepidop., Heterocera," pt. 8, p. 237). All the species of the genus *Ageronia* (a genus peculiar to the tropical parts of America), whose history is known, produce in flying a sound which a good observer has compared to the rustling of a piece of parchment, to which, also, M. Lacordaire compares it. Mr. Darwin, in his "Researches in Geology and Natural History," has the following passage in regard to one species of this genus, *Papilio feronia*:—"A far more singular fact"—the fact alluded to is, that this butterfly uses its legs for running,

the only butterfly he had ever seen do so—"is the power which this insect possesses of making a noise. Several times, when a pair, probably male and female, were chasing each other in an irregular course, they passed within a few yards of me, and I distinctly heard a clicking noise, similar to that produced by a toothed wheel passing under a spring catch. The noise was continued at short intervals, and could be distinguished at about twenty yards' distance. I cannot," he adds, "form a conjecture how it is produced; but I am certain there is no error in the observation"—(Doubleday and Hewitson's "Genera of European Butterflies," letterpress, p. 83).

The past season was one of great scarcity, entomologically speaking; and many insects which I noticed in abundance, and captured to my satiety in 1868, I hardly met with in the same part of the country, and in the corresponding season this year. The plentiful occurrence of *Colias edusa* is an exception to the statement just made; but it has often been remarked that it does not at all follow that good things are not to be met with, although there may be a paucity of the more common insects.

I hope on a future occasion to have the honour of bringing before this Society some specimens of other orders of insects collected this year, and to exhibit specimens of the Neuroptera and Diptera as soon as I shall have arranged and identified them.

Mr. W. F. Kirby observed that it is difficult to obtain perfect specimens of Bombyces, except by rearing them. The oak eggar, commonly found in Ireland, is not identical with the true oak eggar of England (*Lasiocampa quercus*), which is very rare in Ireland; on the other hand, the Irish sub-species (*Lasiocampa calunæ*) is local in Britain, occurring in Scotland, Cornwall, etc.; it feeds on heath instead of oak, and appears at a different time of the year. The Painted Lady *Pyrameis cardui* is known to be a migrating insect, as are several other strong-flying butterflies.

A dwarf sub-species of *Acherontia atropos*, (*A. styx*) occurs in India, and likewise another *Acherontia* (*A. lachesis*), which is fully as large as our common *A. atropos*, but has the fore wings more variegated, and the abdomen and hind wings much darker; it has also the eyes of the skull much more distinct, and the skull itself is more or less marked with red.

The Rev. Dr. Haughton made some remarks upon the connexion existing between the meteorological character of a season, and the abundance and scarcity of insects.

Dr. Foot exhibited to the meeting a series of preserved larvæ, mounted and named for the cabinet, which he had procured from R. L. Davis, Preserver of larvæ to Museums, etc., Albert Road, New Town, Waltham Cross, Herts.

JANUARY 5, 1870.

W. Andrews, Esq., M. R. I. A., Vice-President, in the chair.

The Minutes of the previous Meeting having been read, compared, and signed, donations announced, and thanks voted,

Mr. Wm. Andrews read the following communication "On the Inhabitants of the Rock-pools and Caves of Dingle Bay," during the reading of which, the Chair was occupied by the Rev. Dr. Haughton:—

Recollections of past years, had often brought to mind, when visiting the beautiful caves of Ballybunnion, on the south side of the mouth of the Shannon, the multitude of forms of Invertebrate life that were massed together on the shelving rocky ledges, and in the deep pools of the caves. It was here that I first noticed the varied forms of that beautiful Zoophyte, *Virgularea mirabilis*, at a very low spring tide, apparently imbedded in soft sand.

When contemplating the host of observations that naturally would present themselves for the paper of this evening, "Notes on the Inhabitants of Rock-pools and Caves of Dingle Bay," the selections would be so varied and extensive that many evenings would be occupied. I therefore will confine myself to a few of the most remarkable of those beautiful tribes of Sea anemones or class Zoophyta, which careful investigations have noted,

From the entrance of Dingle Harbour, both easterly and westerly in the bay, are a series of caves and rocky ledges or islets, exposed at low tides. The caves are more or less deep and tortuous, and their examinations are difficult to attempt, from the constant prevalence of westerly winds, which generally send a rolling swell through them. The innumerable and brilliantly coloured objects of animal life that have existence there, can rarely be seen in their developed beauty but at low tides; and many at only the lowest springs. It was therefore that during those equinoctial low tides, in the month of October, 1868, that I was enabled fully to appreciate the countless forms of interest that everywhere presented.

I shall now merely give a few extracts from my notes.

Anthea cereus.—The two varieties occur most abundantly in Dingle Harbour, attached to *zostera marina* and *chorda filum*. The deep-nosed pipe fish, *Syngnathus typhle*, was noticed to feed on the young state of *anthea*, and the grey mullet (*Mugil capito*) also feeds on the full-grown. *Anthea* is also attached to rocks at the entrance of the caves.

Aiptasia couchii.—In a large and beautiful cave westerly of Dingle Harbour, when collecting fine specimens of the Sponge *Pachymatisma*, I was surprised at the singular appearance of this actinia, so nearly allied to *anthea*. It was at an extremely low tide, and the *Pachymatisma* was barely covered by the water, but in most instances *Pachymatisma* was many feet below the surface—in fact the sponge in that locality is not attainable but at low tides.

Attached to the rocks, near the sponge, was the *Aiptasia*, in a perfect state of expansion. The tentacles, as figured in Gosse, are perfect; the colour of the column was more ruddy brown.

Sagartia sphyrodita, *rosea*, and *venusta* were found in pools, the two latter also seen attached to the face of rocks in caves at low tides. The rocks known as the Banaghrees, and those near Coosavoughla, are rich in marine productions, but they can only be explored by boats in moderate weather.

Sagartia miniata.—Surface of rocks in little pools.

Sagartia troglodytes.—East side of Dingle Harbour, rocky pools, imbedded in sand.

Sagartia parasitica.—At a very low tide in one of the deep caves, brought up by means of a small dredge net from a depth of four to six feet. It is well described and figured by Gosse. It is a western species and among the instances of Mediterranean forms that are met with at this part of the coast.

Actinolobla dianthus.—At low water along its range, attached to rocks. I saw most abundantly this beautiful actinia.

Adamsia palliata.—Taken up in deep water close to the cliffs, where those large rocks are off the cliffs, called the Smoothing Iron. I suspect that *Adamsia* is to be found on several species of *Buccinum*. I observed a species of *Purpura lapillus*, and a very pretty form, taken up in forty fathoms, of *Natica nitida*.

Actinia mesembryanthemum occurred in some abundance, particularly the green and variously spotted varieties, mostly attached to the face of rocks, and at the margins of the caves. When retractile I could scarcely know the difference between some of the green varieties of *Sagartia chrysosplenium*, both being of nearly the same shade of pale green, and with dotted lines of white. I did not see forms expanded I could identify as *Sagartia chrysosplenium*.

Tealia crassicornis.—This beautiful species was not uncommon in the caves, and on the rocky reefs outside the caves. Some large and beautiful varieties were noticed near Fort del Ore, Smerwick Harbour. I have a perfect recollection of noticing, and, indeed, noting, a beautiful species of *Cerianthus*, similar to *Lloydii*, in muddy recesses on the west side of Smerwick Harbour.

A *Stomphia*, agreeing with Gosse's figure of *Stomphia Churchiæ*, with exception that the colour of the rim of the disk was a bright purple or carmine lake, was taken up in deep water, forty fathoms, attached to a stone. I may here observe that, while noticing some singular species of ova that were numerously congregated and attached by pedicels to the side of rocks, and also on detached stones, my attention was struck by a pretty coral, which, on minutely examining, I supposed to be dead specimens of *Caryophyllia Smithii*. At the very lowest ebb that occurred during the tides of October, 1868, I in vain sought on the faces of the rocks and in the pools for *Cariophyllia Smithii*, but I was rewarded by meeting that very beautiful coral *Bala-*

nophyllia regia. It was in the recesses of a rocky pool barely covered with water; it could not be extricated it was so imbedded. On the following day I again visited the spot, provided with a heavy hammer and chisel, to force off some of the rock. The tide had fallen to its greatest extent the previous day, and the *Balanophyllia* was not after within reach. On the closest examination I could neither discover *Caryophyllia Smithii* nor the little coral. In the month of August last I dredged *Caryophyllia Smithii* in the living state in fifty-two fathoms. I am, therefore, fully confirmed in the view that it is a deep-water species. In the *Natural History Review* for April, 1859, Dr. E. Perceval Wright expressed surprise that Thompson should have recorded *Cyathina* (*Caryophyllia*) *Smithii* taken on the Nymph Bank, off Waterford. "This," he says, "I regard rather a strange locality, never having dredged them in deep water, and my own experience and that of Mr. Gosse would go to prove that it occurs at or near low water rock, adhering to the perpendicular sides of rock." At the entrance of Dingle Bay, in upwards of fifty fathoms, this beautiful coral was dredged, and I obtained numerous fragments of the same coral among fine shelly sand in sixty fathoms. I am glad to find its deep-water tendency confirmed by Mr. Jeffreys, for since the Paper I gave on the 15th November last, at the Royal Dublin Society, in which I alluded to the deep-water soundings where I had obtained *Caryophyllia*, Mr. Jeffreys, in his report of the deep-sea dredging expedition in H. M. S. Porcupine, given in the *Journal of Science*, "Nature," of 2nd December last, states that he has dredged it in 110 fathoms, about forty miles off Valencia.* Such new facts have been brought to light, and old ideas dispelled, that it is to be hoped that Government may, in the course of this year, again enable, with improved appliances, the same men of science to prosecute further inquiries, for the result of such expeditions must ever be regarded with intense interest.

As I have chiefly alluded to the Sea-anemones, I may mention, when speaking of *Stomphia* as a deep-water species, I met another form in the same soundings—viz., among small stones and *Nullipora compressa*, abundant there, which, when brought up, and placed with other animals in a bucket of water, I could not but observe its remarkable features. It was attached to a flat stone, and had the appearance of a column, partially encased in a lobed tube. It did not long remain in that state for examination, and it contracted to a most undefined form in spirits. In seeking references that might lead to some approximating characteristic, I found none so nearly similar as the *Capnea sanguinea*, described by the late Professor Edward Forbes, in the 'Annals of Natural History,' vol. vii., p. 81, captured in August, 1840—

* In the dredging expedition of the "Porcupine," 1869, in the trip to Rockall, magnificent examples of *Lophohelia prolifera* and *Caryophyllia Smithii* were obtained at considerable depths. In 458 and 180 fathoms abundance of *caryophyllia* were brought up.

'Habitat, deep water, Irish Sea, occurring among millepora.' Professor Forbes further states that where the capnea was dredged, the sea-bottom was chiefly millepora. What is this millepora of the Irish Sea? It is certainly a deep-water species, a stony coral formed by hydroid animals, and related to the Tabulate madrepores, and is nearly allied to, and, indeed, considered identical with *Millepora alcicornis* of Linnæus.

We are well aware that the growth of these corals which form coral reefs of solid stone is entirely confined to warmer regions, their extensions being almost limited to within a few degrees of the tropics. With regard to the depths at which the animals of corals exist, but few seem to have understood the extreme depths in which those hydroids and polyps are in active life. Sir Charles Lyell mentions the several genera of coral that are littoral and sub-littoral, and that the distribution of particular species in regard to the depths of water in which they grow is remarkably uniform. According to Darwin, reef-building corals rarely live at a depth exceeding 120 feet, although it has been shown that some species of coral have been obtained at depths of 900 feet. In temperate climates it is stated that such species as *Caryophyllia Smithii* are sub-littoral. Dr. A. N. Bell, late Surgeon United States Navy, who has written on Protozoa and on Coral Polyps, says that living coral polyps always work upwards towards the light, and that they cannot exist at a greater depth than thirty fathoms. Their peculiar office seems to have been to plant themselves on submarine elevations, and build them up to the surface of the water."

DR. MACALISTER, read the following :—

OBSERVATIONS ON THE MODE OF GROWTH OF DISCOID AND TURBINATED SHELLS.

A MOST interesting paper on the geometrical forms of turbinated and discoid shells was published by the Rev. Canon Moseley in the Philosophical Transactions for 1838, p. 351, in which some important points were noticed regarding the geometrical construction of shell-forms. The author of that paper describes discoid shells as generated by the revolution around a central point of the perimeter of a geometrical figure, which latter, although regularly increasing in size, yet remains always geometrically similar in form. The producing figure in many Gasteropodous Mollusks is represented by the operculum, and in all it may be recognized by making a vertical section in the plane of the radius vector. A turbinated shell is similarly generated, but the generating figure in the production of the helix slips down along the axis instead of revolving in a constant plane. The Rev. Mr. Moseley gives, as illustrations of these points, measurements of *Nautilus pompilius*, *Turbo phasianus*, *Turbo duplicatus*, and *Buccinum subulatum*, and de-

scribes many interesting particulars regarding the formation and growth of the operculum in different shells.

This subject does not seem to have attracted much attention from naturalists, as with the exception of a notice in Professor Goodsir's lecture "On the Use of Mathematical Modes of Investigating Organic Forms,"* it is not, to my knowledge, referred to by any writer on zoology.

While engaged in arranging the large collection of shells in the Museum of the University of Dublin, I was led to make measurements of univalve shells in order to see whether any deduction of zoological importance might be drawn from these valuable geometrical observations, and more especially to determine whether it might be possible to arrive at constant specific numerical parameters in these cases; and in all instances I have been surprised by finding that, in well-formed shells, the ratios of the successive whorls have been specifically constant. In making these measurements, the points to be determined are three, viz.:—1st, the ratio of elongation of the radius vector of the spiral (k); 2nd, the degree of linear expansion of the generating figure in the successive whorls (m); and 3rd, the degree of translation or slipping of the spiral on the central axis (n). The second of these we may call the discoidal coefficient, and the third the helicoidal coefficient.

On applying these measurements to univalve shells, we find that the possible combinations are five in number:—

- 1st, those in which $n = 0$ and $m < k$,
- 2nd, those in which $n = 0$ and $m = k$,
- 3rd, those in which $n = m$
- 4th, those in which $n > m$
- 5th, those in which $n < m$.

The cases of discoid shells in which $m = 0$ are two, the first and second on the list. The first and most uncommon is that in which the amount of elongation of the radius vector in the formation of the successive whorls exceeds the transverse linear increase of the producing figure. The resulting form of this case (which may be formulated thus, $k > m$) is an open spiral, as in the fossil Gasteropodous genus *Eccyliomphalus*, or the Cephalopodous genera *Gyroceras*, *Nautiloceras*, and *Spirula*. The common species of this last genus gives the following measurements:—

Spirula prototypus, $m = 2.6$, $k = 3.3$, $n = 0$. Generating figure, a circle.

Average width of whorls 0.075 in., 0.2 in.†

* Goodsir's "Anatomical Memoirs," vol. ii. p. 209.

† In all the specimens measured and referred to in this paper I have made at least three measurements of each individual, and in the majority of cases I have measured at

It will be noted that all these spirals are true logarithmic curves; and hence the widths of the whorls measured on the radius vector will form a series of numbers in geometrical progression, the common ratio of the progression being, in discoid shells of the second group $m=k$, equal to the coefficient of linear increase of the generating figure. To verify the coefficients deduced from the numbers obtained by measurement, I have used the method given by the Rev. Canon Moseley, which depends upon a well-ascertained property of the logarithmic spiral, and if μ be taken to represent the ratio of the sum of the lengths of an even number (m) of the whorls to the lengths of half that number, then $k=$

$(\mu - 1) \frac{2}{m}$. Applying this formula to the cases given below, I have in the majority of cases obtained results which confirm the ratios of the series of measurements otherwise obtained.

The second case of discoid shells, in which $m=k$ and $n=0$, is by far the commoner, as to it belong all genera of discoidal mollusks, with the few exceptions noticed above. The case $m > k$ is one which cannot occur, as then the outer whorl must necessarily crush the inner, and then the generating figure could not retain its geometrical identity while enlarging; hence we find no examples of it in discoid shells.

I have placed in this second case some instances in which the ratio of slipping or translations on the axis is not easily measured, and virtually amounted to nothing.

The following Table of examples illustrate case No. 2:—

least six specimens of each species. These measurements are in decimal parts of an English inch, and were made with a finely-pointed pair of compasses and a diagonal scale, the eye being in some cases aided by a magnifying-glass. Some specimens were measured by means of sections made in a plane perpendicular to the axis.

Species.	$\frac{n=0}{k=m}$	Generating Figure.	Width of Whorls in decimals of an inch.					
			$\left\{ \begin{array}{l} 0.075 \\ 0.05 \\ 0.15 \end{array} \right\}$	$\left\{ \begin{array}{l} 0.75 \\ 0.5 \\ 1.5 \end{array} \right\}$	$\left\{ \begin{array}{l} 0.02 \\ 0.03 \\ 0.03 \end{array} \right\}$	$\left\{ \begin{array}{l} 0.18 \\ 0.28 \\ 0.17 \end{array} \right\}$	$\left\{ \begin{array}{l} 1.6 \\ 2.7 \\ 1 \end{array} \right\}$	$\left\{ \begin{array}{l} 0.76 \\ 0.17 \\ 0.34 \end{array} \right\}$
<i>Haliotis viridis</i> , ...	10	Ellipse, ...						
<i>Haliotis rugoso-plicata</i> , . .	9.3	"						
<i>Sulculus (Haliotis) parvus</i> , .	6	Oval, ...						
<i>Padollus (Haliotis) excavatus</i> ,	4.2	Ellipse, ...						
<i>Natica canrena</i> , ...	3	Segment of circle, . .						
<i>Nautilus pompilius</i> , ...	3	Segment of ellipsoid,						
<i>Dolium zonatum</i> , ...	2.1	"						
<i>Solaropsis pellis-serpensis</i> , .	2	"						
<i>Planorbis corneus</i> , ...	2	Segment of circle, . .						
<i>Euomphalus pentangulatus</i> , .	2	"						
<i>Architectonica magnifica</i> , .	1.75	Rhomboid, ...						
<i>Architectonica trochleare</i> , .	1.62	"						
<i>Conus betulinus</i> , ...	1.43	Triangle, ...						
<i>Conus literatus</i> , ...	1.4	"						
<i>Conus virgo</i> , ...	1.25	"						
<i>Planorbis</i> , sp., ...	1.38	"						

Hitherto we have been examining the formulæ for discoid shells, but by far the greater number of shell-forms are those in which the whorls, instead of remaining in the same plane, slide down on the central axis, thus making a turbinated shell-form. A new principle enters into our calculation here; for the shape of a turbinated shell depends on the mutual relation of three, and not two constants. These are, first, the form of the generating figure; secondly, the discoidal coefficient m ; thirdly, the helicoidal coefficient n . Upon the relations of these parameters to each other depends the shape of the shell. Thus in some n is nearly equal to m , and in such cases the whorls scarcely embrace each other, and the figure produced is that of an elongated cone, as in the genera *Turritella*, *Cerithium*, *Acus*, &c. Sometimes n exceeds m ; and in this case the resulting form is an open spiral as in *Vermetus*, or a rapidly descending series of whorls. A third possible case is that in which n is less than m , and the resulting figure is globular; but of this case, though a possible one, I have not as yet succeeded in obtaining an example.

The following cases illustrate the formula $n > m$:—

	n .	m .	Width of Whorls in decimals of an inch.				Amount of Translation.			
<i>Vermetus lumbricalis</i> ,	1.42	1.3	0.075	0.1	0.13	0.175	0.15	0.22	0.3	0.45.
<i>Delphinula atra</i> , . .	6.00	2.85	0.018	0.5	0.148	0.41	0.01	0.05	0.3	

The following instances exemplify the case $n = m$:—

Species.	$n = m$.	Length of Whorls in decimals of an inch.									
<i>Helicostyla polychroa</i> ,	2	0.41	0.081	0.158	0.32	0.7					
<i>Fusus colosseus</i> , . .	1.71	0.09	0.14	0.26	0.43	0.76					
<i>Phasianella bulimoides</i> ,	1.8	0.07	0.125	0.23	0.45						
<i>Scalaria preciosa</i> , . .	1.56	0.05	0.078	0.13	0.2	0.32	0.52				
<i>Fusus antiquus</i> , . .	1.5	0.15	0.225	0.343	0.54	0.84					
<i>Mitra episcopalis</i> , . .	1.434	0.245	0.4	0.575	0.82						
<i>Trochus niloticus</i> , . .	1.41	0.2	0.3	0.425	0.63	0.9	1.2				
<i>Fusus longissimus</i> , . .	1.341	0.25	0.3	0.44	0.6	0.81					
<i>Fusus colus</i> , . .	1.33	0.15	0.2	0.26	0.35	0.42	0.54	0.83			
<i>Pyrazus sulcatus</i> , . .	1.33	0.13	0.17	0.29	0.38	0.51					
<i>Acus dimidiata</i> , . .	1.277	0.2	0.267	0.31	0.4	0.52	0.62	0.88			
<i>Acus maculata</i> , . .	1.25	0.15	0.176	0.23	0.29	0.37	0.45	0.53	0.7	0.9	
<i>Acus crenulatus</i> , . .	1.25	0.2	0.35	0.32	0.38	0.496	0.6				
<i>Cerithium nodulosum</i> ,	1.24	0.23	0.3	0.37							
<i>Pirena terebralis</i> , . .	1.23	0.08	0.12	0.15	0.178	0.22	0.28	0.35			
<i>Pyrazus palustris</i> , . .	1.22	0.15	0.182	0.22	0.27	0.34	0.42	0.5			
<i>Zaria duplicata</i> , . .	1.23	0.078	0.1	0.125	0.16	0.2	0.24	0.3	0.26	0.44	0.53
<i>Acus subulata</i> , . .	1.163	0.175	0.2	0.23	0.265	0.32	0.367	0.432	0.47	0.641	0.625
<i>Telescopium fuscum</i> ,	1.14	0.1	0.112	0.125	0.15	0.18	0.2	0.24	0.28	0.325	0.365

The Rev. Dr. HAUGHTON read a Paper "On the Geometrical Classification of Muscles." Referring to Borrelli's old classification he made several alterations in it, adding to it, among others, the class of muscles whose fibres, though straight lines, yet conjointly make skew surfaces.

Mr. J. J. LALOR offered some observations of an original nature upon the manners and habits of the oyster.

Dr. SAMUEL HEWITT was balloted for, and unanimously elected a Member of the Society.

FEBRUARY 2, 1870.

RICHARD PALMER WILLIAMS, Esq., Vice-President, in the Chair.

The Minutes of the previous Meeting having been read, compared, and signed, donations announced, and thanks voted,

Dr. ARTHUR WYNNE FOOT read the following communication :—

ON GOITRE IN ANIMALS.

I HAVE lately had an opportunity of seeing a goitre in a bitch pup of the black and tan terrier breed, and it occurred to me that it might not be uninteresting to bring the animal under the notice of the Natural History Society, and to make a few remarks upon the subject of goitre in the lower animals. I do not bring the case forward as a rare or even as a novel circumstance; but it suggests various considerations, which I venture to think are not altogether unworthy of the notice of this Society. Observations upon animals in health are always acceptable to naturalists, and I can hardly be mistaken in supposing that observations upon the subject of the diseases of animals would also be welcome to them, since no one can fail to be aware of the great and increasing value attached to comparative pathology in the present day. The visitation of the Cattle Plague in 1865-66, has given a surprising impulse to this branch of science, and has caused it to assume an importance quite new to it in England. It would be difficult to exaggerate the value of the study of the diseases of animals; it may be looked at from a commercial or from a national point of view, according as it tends to affect a valuable source of income, or conduces to the maintenance of the public health; or even a more personal view may be taken of the subject, if we consider for a moment the question of the diseases which originate in animals, and which are communicable to man, such as favus, glanders, hydrophobia, and the trichina disease. A further argument in favour of the importance of inquiring into the diseases of animals is the fact, that the phenomena of disease in the simpler forms of the creation, serve to elucidate the phenomena of disease in man; and as the problems of physiology and of structural anatomy are best studied in the lower and simpler forms of animal life, so also are many of the morbid processes which affect the existence of man himself.

On the 24th November, 1869, a young bitch pup, of the black and tan terrier breed, was shown me with a bilobular swelling at the root of the neck, in the situation of the thyroid glands; this swelling had been noticed soon after birth, and had been increasing in size up to the time when I saw it. There had been three pups in the litter, and

another of the three was similarly affected. There had been nothing of the kind observed in either of the parents. The tumour was very visible, especially in profile, and when the pup was let run along the ground the neck bagged downwards like a dewlap—the girth of the neck over the tumour was eight and a-half inches. The tumour gave a thrilling impulse to the fingers, and when pressed against the ear a *bruit* was audible; but it was not easy to ascertain whether this sound proceeded from the tumour or from the arteries of the neck. There was no protrusion of the eyes, difficulty of swallowing, or alteration in the voice perceptible. It was a lively and active pup, and the gentleman who owned it, being anxious to rear it, had shown it to me for the purpose of knowing what would cure it. I recommended him to rub tincture of iodine diligently to the swelling, and made an agreement with him, that if the treatment proposed did not prove beneficial, I should be given the pup to do what I liked with it. When I next heard of it, 17th January, 1870, the report was that the swelling had been so much reduced, that the pup was not likely to become my property. The pup has now grown very much, the swellings are smaller, but still in the same situation, distinctly double, soft and elastic to the feel, moving up and down with the windpipe, apparently making no interference with the neighbouring parts. The circumference of the neck over the swelling is now eight inches; but the natural increase from growth in the thickness of the neck, in the space of more than two months, prevents this measurement of the prominence of the tumour being an accurate indication of its decrease in size.

I may perhaps be allowed to refer for a moment to the nature and situation of the part which is the seat of the affection, popularly known in men and animals, as goitre. The disease consists in an enlargement of an organ in the neck, closely related to the windpipe, and called the thyroid body, from its proximity to one of the cartilages of the larynx, shield-shaped in man. This organ is recognisable in all classes of mammalian animals; yet its use is totally unknown, and respecting its functions, nothing reasonable has even been suggested. It is a most remarkable fact that, in reference to a permanent body found in all the higher animals, and whose conditions in health and disease can be investigated almost daily, nothing beyond its anatomical structure should be known; no satisfactory hypothesis having yet been suggested as to its office or function in the economy of man or the lower animals. This thyroid body consists of a pair of oblong, rounded masses, which in some of the higher mammalia, as in man, are united by a transverse band of like substance, crossing the sternal aspect of the air tube. The thyroid glands of the adult lioness, here exhibited, will best illustrate the usual appearance of this structure. It is this organ which is the seat of the affection called goitre, probably from the word *guttur* or throat. Many animals have been observed to be subject to goitre, and I have endeavoured to collect, by research and inquiry on the subject, as many cases of the occurrence of this affection as possible, in order that they may form a nucleus for a larger collection, or

serve as a starting point for further investigations. There are instances on record of goitre in the following animals:—lion, hyena, dog, cat, pig, horse, cow, sheep, goat, mule, monkey, racoon, and mouse.

A small hyena died in the Surrey Zoological Gardens, 14th January, 1846, with an enormous goitre in his throat; the animal had lived twenty-four years in those gardens; it had arrived in England quite young in the year 1820. The stuffed skin and the skeleton of this animal are in the Museum of the Royal College of Surgeons, London. Besides the fact of the goitre in this hyena, it is interesting to be able to know its age at the time of death; because the duration of life of savage animals, either in their wild state or in confinement, is a subject upon which there is a great want of precise information.

The thyroid glands have occasionally been found very much enlarged in young lion cubs. In April, 1864, Dr. Crisp exhibited to the Pathological Society of London ("Transactions," vol. xv., p. 260) the thyroid glands of three lion cubs—one belonging to one lioness, and two to another. In each cub the glands were enlarged to twenty times their natural size, and he believed that death was occasioned by their pressure upon the recurrent laryngeal nerve at the time of birth. The cubs were well formed, of the natural weight, and all other parts, except the thyroids, were normal. On another occasion, Dr. Crisp found a similar affection in a young lion cub. Another young lion lived to the age of four or five months with very large thyroid glands. Dr. Crisp observes at the close of his remarks, that he has not been able to find a well authenticated case of greatly enlarged thyroid glands in a child, at birth; but congenital goitre has been occasionally noticed; for example—Hedenus [Hasse Pathol. Anat., Syd. Soc., p. 386] has presented to the Museum of Leipsic a preparation in which the enlarged thyroid gland of a new-born infant is seen engirding the whole tube of the windpipe—strangulation was the consequence. There are examples also of intra-uterine goitre in the human foetus of five and a half months, and other instances in which such enlargements in infants at birth have interfered with parturition, by preventing the proper flexion of the head upon the thorax, and caused the death of the child. The title of the Paper, of course, confines me to the subject of goitre in animals, and I only digress for the purpose of illustrating what I have to say. The diseases of animals are in many cases so closely connected with those of man, that it is almost impossible to understand those of the lower class without frequent reference to those of the higher. Congenital or acquired goitre has not been noticed in the few lion cubs that have died in the Royal Zoological Gardens in Dublin. Out of the seventy lion cubs which have been born in the Dublin Gardens from the year 1857 up to the present date (February, 1870), but six have died at or soon after birth. Of three of these I have examined the thyroid glands, with a view of ascertaining if they were diseased, and if not, their natural weight and size, so as to have some standard to which to refer in cases of alleged enlargement. The normal size of these glands in young cubs is very small; in one cub, a female, which

weighed forty-six ounces, the thyroid glands weighed four grains; in another, a male cub, which weighed thirty-three and a half ounces, the glands weighed one grain and three-quarters; in a third, a female cub, weighing forty-one ounces, the glands weighed six and a half grains. These three cubs died immediately after birth, apparently from having been the weakly ones of litters larger than usual. The thyroid glands of a full grown breeding lioness, which died lately from perforating ulcer of the stomach—a disease which proved fatal to a camel in the Hamburg Zoological Gardens in August last—weighed 188 grains. It may be of use to record these few observations on the size of these organs in the young and full grown lions.

I am indebted to Dr. Murie, the Prosector of the London Zoological Gardens, for an account of a goitre in a racoon, and of the operation performed for its removal. An adult female racoon had been in the Gardens for about three years and a-half, during which time she had apparently enjoyed perfect health. At the end of the time stated, a slight swelling of the throat and under jaw was observed; but as the animal took her food well and regularly, nothing was done in the way of alleviation. Months elapsed, and the only sensible alteration was a gradual increase of tumidity in the parts. Great difficulty was experienced in making an examination; so it was almost a year after the tumour had been noticed that active interference was attempted. An examination of the parts affected was made while the animal was under the influence of chloroform, the administration of which proved tedious, as no sooner did she get a whiff than she rolled herself up, and bit indiscriminately at whatever approached her. Dr. Murie was convinced, by the examination, of the presence of a semi-solidified tumour, the nature of which was somewhat uncertain, though from its position and a degree of fluctuation, he feared an abscess and the implication of the left thyroid gland. As treatment by medicine was considered to involve great difficulties, it was resolved to try the effects of an operation. Dr. Murie removed an encysted tumour, but, in doing so, discovered another on the opposite side of the neck, which, previous to the incision being made, could not be felt, from the tense and swollen condition of the parts. A considerable quantity of blood was lost during the operation, and the animal died in about an hour afterwards, apparently through shock or sanguineous loss. The tumours proved to be enlarged thyroid glands. I may mention that the number and size of the blood-vessels connected with this organ must always make its removal a difficult and dangerous proceeding. The diseased thyroid glands have been several times successfully removed in horses; but they are not so largely developed as in carnivores and ruminants, and strange to say, the successive or simultaneous extirpation of these organs has not appeared to influence the health of the animal in any way, so that no light is thrown upon the function of this part by the operation. (*“Chauveau Traité d'Anatomie Comp. des Animaux Domestiques,”* p. 437.) It does not appear that the strictly vascular form of goitre has been observed in the lower animals.

Some years ago the subject of goitre in domesticated animals was investigated by M. Baillarger ("Med. Times and Gazette," October 4, 1862), an eminent French physician, and several statements of importance made with regard to this affection. He found that in a number of places in the departments of the Isère and Savoie, the greater number of mules had an immense hypertrophy of the thyroid body, and of a much larger size than that generally seen in man. In one stable in Modane, amongst twenty animals, nineteen were affected with this disease; and of all the mules examined, only one-third were free from it. Amongst horses goitre was not nearly so frequent; but still much more so than is generally believed. In one place seven horses were examined, which were well fed and cared, lodged in light and well-ventilated stables; and yet four of them had goitre. The same disease was found to exist, in a diminishing ratio, in dogs, cows, sheep, goats, and pigs. The human population of the districts in which the domestic animals were thus affected, likewise suffered from enlargements of the thyroid glands. The fact of the frequency of goitre among mules is of great interest, as these animals are sterile, and sterility is a characteristic feature of a certain class of goitrous human beings. Dr. Edwards Crisp informs me that cast colts are never subject to it, but that it is not uncommon in blood colts, and that occasionally in thoroughbred animals the thyroids have been removed in consequence of the disfigurement they cause being regarded as a blemish in valuable animals. Others have observed, that the horse is not very liable to goitre. Youatt (on Horse, p. 258), remarks that Mr. Percival is almost the only author who takes notice of enlargement of the thyroid glands in the horse. They sometimes grow, he says, to the size of an egg or larger; but are unattended by cough or fever, and are nothing more than an eyesore. He has also seen the disease in a monkey. It appears that certain breeds of the dog are particularly liable to this disease. Mr. Youatt says the spaniel or pug are the most so; that if a spaniel or pug puppy is mangy, pot-bellied, rickety, or deformed, he seldom fails to have some enlargement of the thyroid glands. Exertion causes him to pant from the pressure of the swelling upon the wind-pipe, and Youatt has seen suffocation ensue; an occurrence which has happened in the human subject from a similar cause. He further observes, that there is a breed of the Blenheim spaniel, in which periodic goitre is well-marked, the slightest cold is accompanied with enlargement of the thyroid glands, but the swelling altogether disappears in the course of about a fortnight; he is quite assured that goitre in dogs is hereditary, and thinks that no one accustomed to dogs can doubt this for a moment. He is satisfied that iodine has almost a specific action in reducing the swelling. Blaine ("Canine Pathology," 2nd ed., 1824, p. 113), observes that bronchocele, which is synonymous with the term goitre, is a very common complaint among dogs; and that pugs, barbetts, and French pointers are peculiarly liable to it. (The barbet is a small poodle, the result of some unknown and disadvantageous cross with the true poodle.) He thinks that in dogs it rather runs in the breed than

depends upon local or endemic circumstances. Other dogs, as terriers, spaniels, &c., sometimes have it; but in the larger tribes it is very seldom seen. The swelling comes on generally while very young, and continues to enlarge to a certain size; after which it usually remains stationary, seldom increasing to such a degree as to prove fatal. It is, however, troublesome, and in some measure hurtful from the pressure it occasions on surrounding parts. In some experiments, which M. St. Lager has recently performed, with a view to establish his theory of the geological origin of goitre in men and animals, he has found that mice acquire goitre very readily. Out of a dozen of these animals, which he kept for three months, three had enlargement of the thyroid gland at the end of that time; and these three diseased mice had had sulphide and sulphate of iron mixed with their food, while the rest had had various other mineral substances administered to them. He also experimented on two dogs, with a view of producing goitre artificially, but both of these came to an untimely end, by devouring the "appâts," or enticing bait, which the French police employ to destroy stray dogs. One, however, who had been taking small doses of the sulphide of iron daily for four months, had a decided though slight hypertrophy of the thyroid gland. He suggests, that in case any one should desire to repeat these experiments, either dogs or pigs should be selected, as the herbivora seem to be less liable to goitre, where it is endemic, than the omnivorous or carnivorous animals.

In considering the subject of goitre in animals, it is necessary to review briefly the conditions which appear to induce the complaint in man, as the same conditions undoubtedly operate, to a great degree, upon the lower animals. The snow-water theory of its cause has long been given up, on account of the occurrence of the disease in tropical climates, such as Brazil, Java, India, and Sumatra. Towards the end of the last century, Coxe and Deluc first suggested that carbonate of lime was the noxious ingredient in the water used, and subsequently the magnesian salts were blamed. Dr. Inglis ("Treatise on English Bronchocele") accused the ridge of magnesian limestone running from north to south through the centre of Yorkshire, and margining the shires of Derby and Nottingham, of being concerned with the prevalence of goitre in these parts of England. However, in the case of the city of Paris, the water is very hard, and contains sulphate of magnesia enough to purge most new-comers, but goitre is almost unknown there. After the curative action of iodine was discovered by Coindet, Prevost suggested that the disease might be owing to the absence of that element from the water used. The Sardinian Commission lately appointed to consider the question of the cause of goitre, leaned to the view that privation and a generally defective hygiene had very much to say to it. The most recent culprit is, according to St. Lager, iron pyrites. There appears to be a great deal of evidence in favour of the calcareous origin of goitre in animals. The disease is defined in a standard medical work ("Aitken's Pract. Med.," ii. 57), as "a specific affection of the thyroid gland, induced by the persistent use of water,

which has percolated through magnesian limestone rocks or strata, and containing the soluble salts of lime and magnesia in solution." In the Kingdom of Oude, which is considered to be geologically made up of the alluvial detritus of the Himalayan chain, goitre is very common in animals. The water percolating through the soil of the province contains abundance of lime held in solution by carbonic acid. At Hissawpore, a village about twelve miles distant from Secrora, on the Surjoo River, dogs and other animals are affected with goitre. Goitre in animals has also been observed in Nepal. On one occasion, a goat gave birth to a kid with a goitre as large as its head; and it is noticed that pups of a month old, bred from English dogs, are very frequently affected by it, and also lambs. McClelland observed that dogs and colts were often affected with goitre in certain districts of Gorruckpore. It appears to be from some peculiarity in the water they drink that animals acquire this complaint. It is a matter of notoriety, that there are springs in Savoy which will infallibly give goitre to all, men or animals, who drink of them. It is said, that the drinking water of La Maurienne (Savoy) so rapidly produces goitre, that young men liable to the conscription are known to make use of this means of escaping military service. The difficulty is to find what ingredient it is in the water which has this effect. From a close examination of the geology of France, Switzerland, and Lombardy, especially of the districts where goitre occurs in men and animals, M. St. Lager comes to the conclusion, that where goitre is endemic there the soil will always be found to contain iron pyrites; copper pyrites, galena, and baryta are also frequently found. Where goitre is found occurring on alluvial soils, the soil has been brought down from strata containing pyrites, as in the valleys of the Rhine and the Po. Goitre is endemic in Surrey, Sussex, Hants, Bucks, and Norfolk, on chalk containing silex and pyrites, and in Derbyshire and Nottingham over coal containing pyrites. On volcanic soil goitre is observed when sulphurous vapours are in contact with ferruginous clays, as in Java, Sumatra, and the Azores. It appears to me that the study of goitre in the lower animals offers attractions to the geologist and the naturalist, and that it presents a fresh and wide field for observation. The geography of disease is in many cases mapped out by the affections of the lower animals as plainly as by those of man; and in no case more distinctly than in that of goitre. The lower animals are seen in this instance to be affected by local terrestrial conditions, in a manner similar to man himself; and they at the same time afford a simpler field for study. Independently of the humane motives which ought to impel every lover of nature to care and cure, if possible, the diseases of the lower animals, he must feel that in doing so he is likely to be instrumental in directly benefiting the human race. The great exertions which are being at present made to raise the science of Comparative Pathology to its proper rank, testify to the importance of this long-neglected branch of knowledge; and will, I hope, be taken as my apology for having made these very few remarks before this Society. It is very much to be desired, that

observations could be made upon the sex of the animals affected with goitre, with the view of ascertaining if the complaint shows the same preference for the female sex it has been remarked to do in the human race, 90 per cent. of cases of goitre occurring in women. The literature of goitre in animals is at present scanty and scattered. I have mentioned the animals in which the disease has been noticed, as far as I have at present been able to ascertain—lion, hyena, racoon, monkey, dog, cat, pig, horse, mule, cow, sheep, goat, and mouse—and have alluded to the principal geological conditions which have been alleged as concerned in its production; and I venture to express a hope, that the members of the Society may become sufficiently interested in the subject, and consider it of sufficient importance to record any instances which have already come or may hereafter come under their observation.

Dr. MACALISTER read a paper “On the Comparative Anatomy of the Sartorius muscle,” with especial reference to its homotypical anatomy. This muscle is supposed by Professor Huxley to represent one of the heads of the biceps flexor cubiti; but this view is inconsistent with its relationship to the extensor muscles, to the second joint of the limb, and to the iliacus muscle. The varieties of the sartorius met with in the Nyl Ghaie and Ai indicate the relationship of this muscle to the iliacus; so if this latter muscle be the homotype of the sub-scapularis, the sartorius will correspond to the tricipiti accessorius or dorsi-epitrochleus muscle.

Dr. Foot exhibited specimens of the following species of dragon-flies, which he had collected during the past summer in the county Wicklow, and made some observations upon the means of preserving these insects:—

- Libellula striolata.*
- „ *quadrimaculata.*
- „ *coerulescens.*
- Calypteryx virgo.*
- „ *splendens.*
- Agrion elegans.*
- „ *minium.*
- „ *puella.*
- „ *cyathigerum.*
- Æschna pratensis.*
- „ *junceæ.*
- „ *grandis.*
- Lestes nympha.*

MARCH 2, 1870.

Rev. Professor HAUGHTON, F. R. S., Vice-President, in the Chair.

THE Minutes of the previous Meeting having been read, compared, and signed, donations announced, and thanks voted :

Professor RAMSAY H. TRAQUAIR exhibited three fine specimens of the rare ganoid fish, *Calamoichthys Calabaricus*, from the Old Calabar River. These specimens were much larger than the original specimens described by Dr. Smith of Edinburgh.

Professor MACALISTER exhibited a specimen of the lizard *Ameiva guttata* of Brazil, which was killed on Mangerton, county Kerry. The animal had most probably been a very recent importation, as it was quite lively when killed. Dr. Macalister showed an American specimen of this, not uncommon, lizard for comparison.

The Rev. Professor HAUGHTON detailed the circumstances connected with the death of a lioness in the Royal Zoological Gardens, Phoenix Park, and described the pathological appearances discovered on *post-mortem* examination in the viscera, the most interesting of which were a large perforation in the coats of the stomach, two corpora lutea in one ovary and one in the other.

APRIL 6, 1870.

RICHARD PALMER WILLIAMS, Esq., Vice-President, in the Chair.

THE Minutes of the previous Meeting having been read, compared, and signed, donations announced, and thanks voted :

Professor MACALISTER exhibited some Arachnidan parasites from the *Ornithorynchus paradoxus* of Australia.

Mr. WILSON, F. R. C. S. I., exhibited a collection of Coleoptera from the Rhine Valley, collected in the district between Mannheim and Bonn, and in connexion therewith made a series of very interesting remarks upon the habits and economy of several of the species represented in the collection.

MAY 4, 1870.

WILLIAM ANDREWS, Esq., Vice-President, in the Chair.

THE Minutes of the previous Meeting having been read, compared, and signed, donations announced, and thanks voted :

The CHAIRMAN read the following communication, entitled—

ICHTHYOLOGICAL NOTES.

THERE are no subjects fraught with greater interest than discoveries which arise from a practical knowledge of any branch of science, whether it relates to botany, geology, or to any of the orders or genera of zoological investigations.

When we contemplate the vast scope of the branches of the natural sciences, we cannot fail to meet most perplexing difficulties in the determining of correct classification, the opportunity of practical investigation not being afforded; for without that most essential aid, no certainty can possibly be arrived at, especially true characteristics depending upon habit, geographical range, seasons, depths, and peculiarities of soundings, and on those natural causes which influence forms and changes of animal and vegetable life.

The subject of the Paper this evening relates to deep-water species, the present observations being with reference to notes on some fish occurring on the south-west coast of Ireland, in Dingle Bay, and off the coast of Kerry. I have before brought to notice, at a meeting of this Society, the discovery of the *Sebastes Norvegicus*, Norway haddock, on that coast, a fish peculiar to deep water, and to those character of soundings favourable to the haunts of the codfish. Hence, off the Faroe Islands and the coast of Norway, it is well known to the fishermen as the frequenter of grounds the favourite locality of the codfish. On the coast of England its record is not well authenticated; but on the coast of Scotland, and especially Zetland, it has been occasionally obtained. It is truly a deep-water species, and the fine specimen exhibited was taken on a long line, at a depth of sixty fathoms, the soundings being coarse shingly gravel, abounding in crustacea and mollusca.

Some most interesting Crustaceans and species of rare fish have been met, which are confined to peculiar soundings in deep water; yet I may say that at a depth beyond eighty fathoms much of interest as to variety of forms ceases, and the dredge in soundings of 100 fathoms, and beyond that depth, rarely brings up but remnants belonging to shallower soundings, or those forms of foraminifera and globigerina which require microscopic manipulation in the determining of their numerous forms.

It is singular, however, the extreme depths that minute *Crustacea*, *Echinoderms*, *sponges*, and *corals* are brought up; therefore I may say that when we proceed further than a depth of eighty fathoms the interest, so far as the ichthyologist is concerned, to a great extent, closes. Wherever crustacea and mollusca abound there the fish congregate, yet those depths are generally most prolific between the soundings of thirty to eighty fathoms; and again, wherever fish most congregate their enemies invariably frequent. *Dogfish* and *Sharks* are numerous and troublesome to the long lines of the fishermen. The large spotted dogfish (*Scyllium catulus*), the common tope (*Galeus canis*), the smooth hound (*Mustelus vulgaris*), and the black-mouthed dogfish (*Pristiurus melanostomus*), I have frequently met. The picked dogfish (*Acanthias vulgaris*) are numerous in deep water as well as in shoal water when running up the bays and inlets in pursuit of fry, especially of sprat and the herring. The specimens exhibited of the young state, with the vitelline sac attached, were taken in deep water off the Wild Bank in

the month of July. The parent fish, when brought on board, exuded the young in that state on the deck.

In soundings of thirty fathoms, among small stones, millipores, and coarse sand, I took numerous specimens of rare crustacea. I shall only now allude to some beautiful specimens of *Lepodogaster* of a most beautiful vermilion colour, it was *L. bimaculatus*, which by their suckers were firmly attached to the stones. I had formerly noticed *L. cornubiensis* to have been taken in pools at low spring tides, at the west Blasket Island.

To obtain any knowledge of utility in our fisheries, the character of soundings must form our particular research, for the habits of all kinds of fish, their superiority of growth or goodness, depend so much upon peculiar feeding grounds, and on animal life that afford their sustenance, that on such we must depend, in the proper seasons, for the more certain capture of the different kinds of our more valuable edible fish.

Fine specimens of the red mullet (*Mullus surmuletus*) have been taken in Brandon Bay, Kerry, and off Ventry Harbour, Dingle Bay¹. The mention of the above localities leads me to make some remarks with reference to the Clupeidæ, or herring family.

Some years since, when the fisheries of Dingle Bay were more extensively worked than they are at present, or rather, when fishermen and boats were more numerous, herrings were taken in great quantities; now the men who have good boats turn their attention almost entirely to trawling and to line fishing. I was then much surprised to meet in quantities the true sardine of commerce, and in after years constantly noticed them, being the young of the pilchard. No suitable nets or means of capture were ever attempted by the fishermen, although they annually frequent the Bay of Dingle. My lamented and excellent friend, the late William Thompson, of Belfast, was much surprised when I communicated to him the meeting in the estuary of Brandon Bay of the true whitebait (*Clupea alosa*). It was the young of the Alosa which ran up into the brackish water of the estuary to spawn, and where the young fry are met. The Alosa also spawns in the Lakes of Killarney, and are taken there by the fishermen when hauling for salmon. I have seen the young of the Alosa and the fry of the herrings in the fishmongers' shops of London on sale as whitebait, and large quantities of herring fry have been taken at the entrance of the River Liffey and sold for whitebait. There is no doubt that both the fry of the herring and the fry of the shad have both been sold and described as the whitebait, the latter more particularly, which is correctly figured by Donovan ("British Fish," plate 98).

I am led now to bring to notice another interesting species of the Clupeidæ, the true Anchovy (*Engraulis encrasicolus*), the first time placed on record as captured on the shores of Ireland. I had heard of a species of small herring that had been taken in the herring nets of a peculiar silvery brightness. I was delighted to obtain a specimen last

autumn off Ventry Harbour, being another among the many interesting additions that have been made on that part of the coast of fish peculiar to the Mediterranean. The specimen exhibited is of full size, being in length six inches, thicker in proportion than the herring, no serrations on the abdomen, and the sides and belly being of the most silvery brightness, and having no apparent scales. The back was a dark bluish green; the mouth with a remarkably wide gape; teeth exceedingly minute in the maxillary; none in the lower jaw; snout much projecting. At first examination I thought it might be a species of *Melette*, as it did not bear sufficient resemblance to several of the figures of the anchovy in works on ichthyology. The best and most perfect outline of the specimen is that figured by Duhamel—"Traité des Pêches," vol. ii., sec. 3, pl. 17, fig. 5. Duhamel has given most elaborate details of the characters and modes of fishing for the anchovy. The anchovy is chiefly taken in the Mediterranean, principally off the coast of Sicily, the Isles of Elba, Corsica, Antibes, Frejus, Saint Tropez, and Cannes. They are chiefly prepared on the Provençal coast. It has been met in several localities on the coast of England, and Mr. Couch considers that it may be abundantly taken on the Cornwall coast. Gunther mentions specimens in the British Museum, obtained from Van Diemen's Land and New Zealand, and states a difference between European specimens and those from the southern hemisphere is the slightly increased number of the anal rays, eighteen to twenty. This, however, is the first record of its capture on the shores of Ireland, and it is not unlikely but that in the autumn season the anchovy, with nets of a proper mesh, may be taken in Dingle Bay and other bays on the south-west coast.

DR. ARTHUR WYNNE FOOT read the following paper:—

ON THE BREEDING OF SOME BIRDS FROM THE SOUTHERN HEMISPHERE IN
THE DUBLIN ZOOLOGICAL GARDENS.

A PAIR of *Cereopsis* geese were purchased by the council of the Royal Zoological Society, 7th September, 1866. On the 17th November, 1868, a nest, made by the goose, was found with three eggs in it, on the evening of the same day a fourth egg was laid in it, and a fifth on the 19th. The goose sat on the nest from the time it was discovered till the 19th, when the superintendent put a crate over it for the purpose of sheltering it; this caused the goose to forsake it. The gander remained near the nest as long as the goose was sitting, and showed fight when any one approached it; the circumstance of his running at the superintendent when he went near the shrubbery in which the nest was, first led Mr. Carter to suspect the goose was hatching in the neighbourhood, and to make a search for her. The nest was made of sticks and twigs arranged in a circular form on freshly dug ground at the foot of a lilac bush, the mass of twigs measured two feet in diameter and was raised about six inches from the ground, the central part of the platform was lined with the grey down and small feathers of the goose. The nest was in an elevated part of the gardens quite away from the

water. There was no fear of there being any cross breeding between the *Cereopsis* goose and any of the males of the other numerous varieties of geese about the grounds, no other gander would be allowed to approach her; these Australian geese at all times bully the other geese, pursuing them until the latter take to the lake, whither the *Cereopsis* will not follow, appearing to have a great dislike to water. On the 12th December, a little more than three weeks after she had forsaken the five eggs first laid, the *Cereopsis* goose was observed to be building again, not far from the former nest, but in a much more open and less sheltered situation: the second nest was made on clay at the foot of a laurel tree, beside a walk and within six feet of a cage in which was a white-headed eagle which attracted many visitors. An egg was laid 14th December, a second on the 16th, a third on the 19th, a fourth on the 20th. The gander remained continually on guard, and ran at any one who went too near the nest and goose. Whenever she left the nest she concealed the eggs by pushing the loose feathers over them with her bill. The four eggs were hatched 23rd January, 1869, thirty-five days from the day on which the last egg was laid, reckoning both that day and the day on which the goslings appeared. Five days after they left the shell they were of a mottled colour, grey and black, the cere quite grey; they fed themselves with meal and water, grass, and bread and milk. In about three weeks they were marked with three black streaks, a median and two lateral ones, commencing on the head and passing down along the neck and body. But one of the four survived.

Nine eggs in all were laid, five in December, '68, four in Jan., '69; the former batch were deserted, the latter hatched out. The major axis of the eggs measured $3\frac{1}{4}$ inches, the minor $2\frac{3}{8}$; their average greater circumference about $8\frac{1}{2}$ in.; average smaller $7\frac{1}{4}$ inches. On the 1st of November, 1869, the same *Cereopsis* goose had made another nest and laid the first egg; a second egg was laid on the 3rd, a third egg on the 6th (the fifth being a very wet day, she appears to have postponed the egg due on that day to the subsequent one), a fourth egg on the 7th, a fifth on the 9th: all were hatched out 13th December, thirty-five days from the day on which the last egg was laid, reckoning both that day and the day on which the goslings appeared: the five died young. The goose laid an egg again 18th February, 1870, a second on the 22nd, a third on the 24th; two goslings were hatched out 1st April—the third egg was addled.

Mr. Gould remarks that the *Cereopsis* goose—the Cape Barren goose of the colonists—is one of the Australian birds which particularly attracted the notice of the earlier voyagers to that continent as being very plentiful on all the islands in Bass's straits, and so tame that they might be easily knocked down or even captured by hand. During Mr. Gould's sojourn in that part of the world he visited most of the localities above-mentioned, and found that so far from its being still numerous it is almost extirpated; a few, however, he found still inhabiting the smaller islands in Bass's straits, and he killed a pair on Isabella island, one of a small group near Flinder's island, on the 12th January, 1839.

He believes that it may still be abundant on some of the unexplored parts of the south coast of Australia, but in the colonized districts where it has been much molested, it has now become so scarce that it is very rarely seen. The *Cereopsis* goose passes the greater portion of its time among the grass, and rarely takes to the water; it appears to be strictly a vegetable feeder; and to subsist principally upon grasses in the neighbourhood of the coast; consequently its flesh is excellent, and all who have tasted it agree in extolling its delicacy and flavor. It bears confinement remarkably well, but is by no means a desirable addition to the farmyard, for it is so pugnacious that it not only drives all other birds before it, but readily attacks pigs, dogs, and any other animal that may approach, and often inflicts severe wounds with its hard and sharp bill.

The period of the year (November) in which, during the two past years, the *Cereopsis* goose began to lay in the Dublin gardens is that at which the greater number of the birds of the Southern Hemisphere begin to build and sit on their eggs. The habit of laying at a particular season may be considerably affected when birds are transported from the Southern Hemisphere to the Antipodes; thus in the London gardens these birds breed in March, and perhaps these breeding later here in their second year than they did in their first shows that they are becoming acclimatised, and are accommodating themselves to the climatic conditions of this country, so opposite to their own. The breeding season of the Black Swan commences in October, and continues until the middle of January. The Piping Crow begins to breed early in the month of September, continuing till January, during which period two broods are generally raised by each pair of birds.* The breeding season of the Grass Paroquets is in December, and by the end of the month the young are generally capable of providing for themselves.† The Semipalmated goose commences to lay in September.‡ The month of November is the breeding season of the Petrels and Ferns of Australia.

The period of incubation of the *Cereopsis* goose is thirty-five days, the same time as the Black Swan and the Rhea.§ The time with our domestic goose is from thirty to thirty-four days; the Sandwich Island goose thirty-one days.

A dislike to water and great pugnacity are two remarkable characteristics of the *Cereopsis* goose. They are complete masters of the other waterfowl. There lurks a combative spirit in some of the other breeds of geese; and in Russia this trait of the genus is appreciated, developed, and turned to account. Geese are trained to fight in goose-pits, as game cocks in this country; the birds peck at each other's

* Bennett, "Wanderings of a Naturalist," p. 224.

† Op. cit. p. 231.

‡ Op. cit. p. 240.

§ Owen, "Comp. Anat. of Vertebrata," vol. ii., p. 257.

shoulders, so as to draw blood; well-trained ganders have been known to sell for as much as £20; and betting on them runs high.

The habit of covering up the eggs when the goose leaves the nest is observed in several of the ducks and geese of the Southern Hemisphere. The upland goose, which inhabits the Falkland Islands and adjacent parts of the South American continent, has this habit. When the female leaves the nest after laying, she covers it up with straw; but if the eggs are set, she covers it up with down; it is supposed her object in the former case is to prevent their destruction by birds of prey, and in the latter to keep warmth in the eggs. This goose has got its name from keeping to the interior of the islands, being seldom or never found near the coasts; it has the same dislike to water and love of grass which the Cereopsis has.

The plumage of the Cereopsis geese is precisely alike in both sexes. It is strange that there is, as a general rule, so little sexual difference of plumage in geese when there is so much in many of the ducks; the male and female of the upland geese afford a striking contrast to each other, although the ashy-headed are exactly alike. Good examples of birds, in which the sexes are exactly alike, as far as plumage is concerned, are snipes, swallows, doves, crows, kingfishers, parrots, and the majority of the waders. Sex may sometimes be determined by sound when not by plumage. Mr. R. P. Williams, who has had much experience of Cereopsis geese, thinks the noise the female makes, a kind of hoarse grunting bark, quite characteristic of the sex. The male of the Warbling Grass Paroquet or love bird (*Melopsittacus undulatus*), known also by many other names, such as the Canary or Zebra Parrot, the Scalloped Parrot, Budgerie-gar of the colonists (budgerie, handsome), has a pleasant inward warbling song, with which, on a fine sunny day, he serenades the female, who apparently listens with great delight and attention, but is mute as far as any agreeable sound is concerned. In the Emeus, in whom the sex cannot be distinguished by the plumage, the female utters a booming noise like a tap upon a large drum. Among song birds the distinction of sex by voice, when the plumage is alike, is very marked. It is unnecessary to allude, as a sexual characteristic, to the difference of pitch in the human voice, amounting to a whole octave. It has been asserted by some, and the opinion is generally entertained by dealers, that the male bird, in the case of parrots and cockatoos, speaks better than the female; but there are some instances of both the rose-crested, white-crested, and lesser sulphur-crested cockatoos being good talkers, and laying eggs in confinement. When plumage and voice fail as sexual diagnostics, size may be taken into consideration; but the male is not always larger than the female. In the case of the hawk, the falcon or female is one-third as large as the tercel or male bird. The female eagle is larger than the male, and in almost all the species of owls, the female exceeds the male in size, the difference being very remarkable in the Snowy Owl (*Surnia nyctea*). Another bird of the Southern Hemisphere, which not unfrequently breeds in the gardens, is the Emeu. One of the hen Emeus laid six

eggs in the month of March, 1869, one of which was broken by the hen bird. The three eggs of the batch of 1869, which were first laid, I weighed and measured at the time; the weights were 17, 20 $\frac{1}{2}$, and 21 ounces; the average major circumference of the three was 14 inches; the minimum 11; the average length 5 $\frac{3}{4}$ inches; average breadth 3 $\frac{3}{4}$ inches. One of the eggs was much smoother and of a paler green than the others. The Kestrel lays four and occasionally five eggs; the fifth egg has been known to weigh several grains less than any of those previously deposited; and it has also less colouring matter spread over the shell than the others. These differences have been attributed to the constitutional exhaustion she has sustained in her previous efforts; and perhaps such may be the explanation of the difference in weight and colour of one of the Emeu's eggs. The Emeu's eggs require from fifty-four to fifty-six days for incubation. As the birds showed no disposition to sit, the eggs were removed as soon as laid, and reserved for sale, it not being considered worth while making an attempt to hatch them artificially. The number of eggs laid by an Emeu in a state of nature is stated to be always an odd number; perhaps in this case the even number, if the contrary be the rule, may be attributed to the effects of confinement. An Emeu's egg is considered to equal in bulk a dozen hen eggs. Mr. Gould observes, that the natives in Australia esteem them very much as an article of food, and feed upon them exclusively whenever they can be procured. The flesh of the bird is said not to be so palatable; it is rich and oily, and very apt to disagree with the stomach. In the narrative of the journey of M'Kinlay across Australia, there is an entry:—"The Emeus made us sick, the meat is so oily; they weighed, when ready for the pot, 48 lbs., 33 lbs., 31 lbs.; the smaller ones were better, and they saved us some sheep, which is a consideration."*

Emeus have been very successfully reared in England in the aviaries erected by the Duke of Newcastle in his grounds at Clumber Park, Nottinghamshire. The adult birds chiefly feed on grass; those of Clumber graze with the cows and horses in an open field, and are fond of cabbage, lettuce, or any garden refuse; but, for their size and weight, are unquestionably small eaters. During the laying season they are also supplied with a proportion of meal mixed with water, or soaked ship biscuits. They are readily kept within bounds by ordinary fences, never attempting to force through a hedge or pass over a gate. They are also very prolific, the hen laying nearly thirty eggs every season. In the year 1868 the hen Emeu commenced to lay on the 5th of January, and laid every second or third day until she had deposited twenty-seven eggs, which were placed on the floor of a shed which opened into a small enclosure in which the birds were confined at that time. After seven eggs had been deposited, the male proceeded to sit

* "Tracks of M'Kinlay across Australia," by John Davis, one of the Expedition. London, 1863, pp. 320, 321.

upon them, and sat steadily for eight days, when the female disturbed him, and he left the nest for eight days, the eggs being exposed during the whole of this time to the severe weather of February. At the end of this period the cock resumed his task of incubation, and sat for sixty-two days after the commencement of the second incubation. At this time it was thought that the health of the male bird would suffer from the long continued confinement and abstinence from food, as he refused to eat anything while on the nest, although food and water were placed within his reach, and he only came off the eggs three times during the long period of incubation. As the date at which the eggs should have been hatched, counting from the first commencement of incubation had passed, it was feared they were not fertile; but on placing them in warm water their active motion soon testified to the existence of living Emeus within; they were consequently returned to the nest and hatched in due course. Of the seven eggs one was rotten, two young Emeu chicks died in the shell, and four were hatched, one of which was accidentally killed by the male. Of the remaining eggs several were eaten, and found of unquestionable excellence. The shell is very stout, and but for the singular breaking up of the arrangement of the structure just before hatching, the chicks would apparently be unable to get out of its strong cradle. The young Emeus were reared by hand lest their parents should injure them, and were for a few days crammed with chopped lettuce, rib-grass, clover, leaves, and custard. Before the end of the first week they had learned to feed themselves, and their chief food soon consisted of grass, rib-grass (*Plantago canceolata*), cabbage, with clover, and some bread and meal. In drinking they were observed to spoon up the water with the lower mandible and allow it to run to the back of the mouth. They soon became so tame that they were troublesome from the difficulty with which they were kept out of the house.

It is fortunate that there do not appear to be any insuperable difficulties in the way of breeding both *Cereopsis* geese and Emeus in these islands, since they are rapidly becoming scarce in their native country, and will probable meet the fate of the original human population of the Australian continent and be exterminated. Dr. George Bennett, writing of the Emeu, says that in 1832 in visiting the interior of Australia he travelled some hundreds of miles before even a solitary specimen was seen, and then instead of the flocks heard of in the early periods of the colony, consisting of a dozen or more, he only saw two or three at the most, and usually only a solitary bird. It is very much to be feared that these birds, with the black swan, the cassouary, the mooruk, the apteryx, the kangaroos, and many other smaller animals of the southern fauna, will become as extinct as the bear, wild pig, wolf, beaver and elk are in Britain, and the dodo, rhytina, moa, and great auk, have in every part of the known world.

The Emeus in the Zoological Gardens have not laid this year as yet, and it is not likely that they will do so this year, as the season is so far advanced; they do not lay every year, but I have no doubt that if at-

tention were directed specially to the subject these animals would be found to reproduce as rapidly in Ireland as they have done in England, France, Belgium, and elsewhere. They exhibit an extraordinary power of resisting cold. At Paris one lived for several years in the open air, refusing the shelter provided for it, and sleeping in winter half covered with snow, protected by its impenetrable fleece of feathers. Its flesh, according to M. Prévost, who forms a more favorable opinion of it than travellers have done, would be valuable as butcher's meat, as the thigh of an Emeu may weigh more than twenty-two pounds, and the Imperial Acclimatisation Society have marked their appreciation of the value of these hardy birds by offering a medal of fifteen hundred francs for their successful domestication.

Dr. ARTHUR WYNNE FOOT then read the following:—

NOTES ON ANIMAL LUMINOSITY.

MY object in bringing the subject of animal luminosity under the notice of the members of the Natural History Society, is not to lay before them any recent personal observations, but to entertain them with a resumé, though a very imperfect one, of some of the principal facts which have been ascertained in the investigation of this subject. In studying any phenomenon of wide distribution in nature, it is well from time to time to pause and review the work that has been accomplished in the past, in order to ascertain the proper starting point whence future inquiries should be instituted, otherwise observations may be recorded and statements reiterated as novel which a little research into the literature of the subject would have shown to have been long forestalled by previous and perhaps forgotten authors. In so large a field of study as that which the subject of animal luminosity affords, and in which so many are working, unknown sometimes to each other, it is quite possible that some of the labourers may not be aware of the amount of work which others with superior advantages may have accomplished, and hence the utility is obvious of now and then taking stock, as it were, of progress, and of seeing how far the work has been advanced by the conjoined exertions of all, great and small, concerned in the task. The subject is one which can hardly fail to arrest the attention, if not to interest, all who are concerned with any branch of natural science; the labour of its study is divided amongst the botanist, the mineralogist, the zoologist, the anatomist, and the student of physics, and by their friendly co-operation vastly greater and more useful results are attainable than by single-handed exertion, even though Titanic Time and a due regard for the feelings of the audience will prevent me from going into anything like a minute consideration of the subject, and will only permit of reference to its salient points, and I earnestly crave indulgence if the remarks made appear desultory, as they can hardly fail to do from the hasty manner in which they have been put together.

The term luminosity has been chosen in preference to the more usual

one of phosphorescence, only because that it in no way implies—at least in respect to the nature of the light emitted by animals—any theory as to the cause of the phenomenon; but in other respects there can be no objection to the use of the term. Phosphorescence is one of the various sources of light, and has been referred by Becquerel* to five causes:—

1. Spontaneous phosphorescence in certain vegetables and animals.
2. Phosphorescence by elevation of temperature, which is best seen in certain species of diamonds and in fluorspar, which, when heated to 300° or 400°, suddenly become luminous, emitting a bluish light.
3. Phosphorescence by mechanical effects, such as friction, percussion, cleavage, &c.; for example, when the crystals of quartz are rubbed against each other in darkness, or when a lump of sugar is broken.
4. Phosphorescence by electricity, like that which results from the friction of mercury against the glass on the tube of a barometer, and especially from the electric sparks proceeding either from an ordinary electric machine, or from a Ruhmkorff's coil.
5. Phosphorescence from insolation. A large number of substances, after having been exposed to the action of solar light, or of the diffused light of the atmosphere, emit in darkness a phosphorescence, the colour and intensity of which depend upon the nature and physical condition of these substances. The sulphides of calcium and strontium are those which present it in the highest degree. When well prepared, after being exposed to the light, they are luminous in darkness for several hours, even for as many as thirty hours, whether in vacuo or in a gaseous medium. Besides minerals, a large number of organic substances also become phosphorescent by insolation; for instance, dry paper, silk, cane-sugar, milk-sugar, amber, the teeth, &c.

Without dwelling longer on luminosity in the mineral kingdom, we may allude to the occurrence of the phenomenon in vegetables. Certain Fungi, particularly species of *Agaricus*, have been observed to emit light. *Agaricus olearius*, not uncommon in Italy, is sometimes seen at night feebly shining amidst the darkness of the olive groves. The mycelium or spawn of the truffle emits light. A Brazilian *Agaricus* is phosphorescent to such a degree, that two or three of such fungi in a dark room give out a pale-greenish light sufficient to read by; and Mr. Drummond has described an Australian fungus with similar properties.† Light is perceived in all parts of luminous fungi, but chiefly in the young white shoots; and it is more vivid in young than in old plants. It ceases if the plant be placed in vacuo, or in any atmosphere which does not contain oxygen, but reappears when it is restored to the air, even after remaining for some hours in vacuo, or in nitrogen. The *Rhizomorpha subterranea*, a fungoid organism occasionally met with in mines, exhibits upon its rami-

* Ganot's "Physics," 1867, p. 480.

† Carpenter, "Principles of Comp. Phys.," 4th ed., p. 442. Badham, "Esulent Funguses of England," p. 15, 1847.

fied structure points which possess an irregular phosphorescence, sometimes rising to such a degree as to enable surrounding objects to be distinguished.* The species of *Rhizomorphæ* are numerous in the coal mines in the vicinity of Dresden, and emit a light like faint moonshine, which is influenced in intensity by the temperature of the mine. Some *mosses* have been observed to be phosphorescent, especially the species of the genus *Schistostega*, which grow in caverns and other damp places. The milky juice of *Euphorbia phosphorea*, a Brazilian plant, becomes luminous when removed from the plants, and gently heated. The leaves of *Phytolacca decandra* have been observed to shine in the dark, sometimes with a bluish-green, sometimes with a yellowish-green light. Decaying wood is well known to be often phosphorescent under peculiar circumstances; it is generally observed in the wood of trees which have been buried in earth while they were in a green state; and perhaps may frequently be caused by the mycelia of fungi, many of which are known to be luminous; it is removed irrecoverably by drying up the damp rotten wood. Dr. Hooker, in the 2nd vol. of his "*Himalayan Journals*," p. 151, gives interesting observations upon this subject. At Doigiling, he says, during the damp warm summer months (May to October), at elevations of 5000 to 8000 feet, the phenomena of phosphorescence in wood may be witnessed every night by penetrating a few yards into the forest. A stack of fire-wood, collected near the cottage in which he was lodged, presented a beautiful spectacle for two months (in July and August); and on passing it at night he had to quiet his pony, who was always alarmed by it. The phenomenon, he continues, invariably accompanies decay, and is common on oak, laurel (*Tethranthera*), birch, and probably other timbers; it equally appears on cut wood and on stumps, but is most frequent on branches lying close to the ground in the wet forests. He had reason to believe that it spreads with great rapidity from old surfaces to freshly cut ones, and did not in the least doubt that it is a vital phenomenon, and due to the mycelium of a fungus, as he had observed it occasionally circumscribed by those black lines which are often seen to bound mycelia on dead wood, and to precede a more rapid decay. He tried often, but in vain, to coax these mycelia into developing some fungus by placing them in damp rooms. When camping in the mountains he frequently caused the natives to bring phosphorescent wood into his tent for the pleasure of watching its soft undulating light, which appeared to pale and glow with every motion of the atmosphere; except in this difference of intensity, it presented no change in appearance night after night. Alcohol, heat, and dryness, soon dissipated it; it had no odour, and his dog, who had a fine sense of smell, paid no attention to it when it was laid under his nose. The statements as to the luminosity of *flowers* are so very contradictory, that fresh observations alone can procure unimpeachable evidence on the subject. The flowers

* Henfrey, "*Element. Course of Botany*," p. 615.

which have been asserted to show phosphorescence are all of brilliant red, orange, or yellow colours—the marigold, orange lily, scarlet poppy, sun-flower, nasturtium, and Indian pink. It has been said by those who have not been fortunate enough to see the phenomenon, that the asserted luminosity was the result of a peculiar effect upon the eye of the observer, arising from the brilliancy of the blossoms; but if the phenomenon were looked for in twilight and on dark nights, at which time it is stated to have occurred, it is difficult to conceive how the colours of the petals could so greatly influence the eye; and knowing the remarkable evolution of heat which occurs during the flowering of plants, and the peculiar electrical conditions of the flower, the facility with which red petals absorb solar rays, and that phosphorescence from insolation occurs in several organised structures, it appears unphilosophical to disbelieve in or deny the possibility of the occurrence, because it may be of an extraordinary nature, and rarely met with. Luminosity has been not unfrequently observed in peat; the appearance is quaintly alluded to by Plot,* as known in Staffordshire, in his well-known work, the history of that county, published in 1686. Speaking of certain clays, he says: “I pass them over, and proceed to another black, moist, and rotten sort of earth, that lyes just under the turf in heathy places, where as I was seriously told by the Worshipful and most ingenious Charles Cotton, Esq., and others, that if one ride in a dark night in so wet a season that a horse breaks through the turf, and throws up this black, moist, spongy sort of earth, he seems to fling up so much fire, which lyes shining upon the ground like so many embers, by the light whereof one horse may trace another, though at some distance, and it be never so dark; it continuing light upon the ground, and being gradually dying away, for near a quarter of an hour. To which,” says he, “let me add another agreeable relation, whereof I was informed by that worthy Loyal Gent., Captain Tho. Lane, Esq., of Bentley, who, endeavouring to help a friend and kinsman of his (one Mr. Jones), who casually fell into a ditch in Bescot grounds in the night time, and having stirred the mud and dirt pretty much in performing that good office, they presently found their gloves, bridles, and horses, as far as the water or dirt had touched them, all in a kind of faint flame, much like that (as he described it) of burnt brandy, which continued upon them for a mile’s riding.” The phosphorescence of turf in the bogs in the western parts of the county of Cork was investigated by G. J. Allman, and its cause, as will be shortly mentioned, ascertained to be a small annelid. No reference is made upon this occasion to the lights often observed in bogs, and other similar situations, caused by the evolution of spontaneously inflammable gases.

Passing from the *vegetable* to the animal kingdom, we shall find that light is emitted from animal bodies under two different conditions, during life as a vital act, and after death. Taking up the consideration

* “The Natural History of Staffordshire,” by Robert Plot, LL. D. 1686.

of the latter condition first, it will be found that posthumous luminosity has no necessary connexion with any *advanced* putrefactive change, or sometimes with any perceptible degree of it: on the contrary, the evolution of light, though not absolutely incompatible with well-marked putrefaction, is almost always annihilated by any great amount of cadaveric decay. Posthumous luminosity has been observed in various kinds of meat, especially in veal, while still apparently quite fresh; also in the flesh of fowls, fish, crustacea, and many of the less highly organized animals, and several communications on the subject were made to the Royal Society during the last two centuries by the Hon. R. Boyle,* Dr. T. Beal,† and Dr. Hulme.‡ One instance of luminosity in veal may be quoted as an example of phosphorescence in dead flesh. At Yeoval, in Somersetshire, a neck of veal, which seemed to be well coloured, and in good condition in every respect, being killed in the evening of the day before, was hung to a shelf in a little chamber. The following day, in the evening (twenty-four hours after it had been killed), the veal shone so bright that the woman of the house was frightened. She called up her husband, who hastened to the light, fearing fire, and seeing the light come only from the flesh, he caught it in his left hand and struck it with his right hand, endeavouring to extinguish the flame, but without effect, as the flesh shone as much as before, if not more, and his hand with which he struck the veal appeared all in a flame, as bright and vivid as the flesh of the veal was, and so it continued as he went from place to place showing it to others; and though he thrust his blazing hand into a pail of water, the flame was not extinguished, but his hand shone through the water. At last he took a napkin and wiped his hand till he wiped off all the light. The next day the veal was dressed, and it eat very well.§ The flesh of fish is that which most frequently exhibits luminosity after death; it has been particularly noticed in the whiting, herring, and mackerel, and has been stated to occur in the sardine, pollock, and pilchard, and other fishes. Freshwater fish, with the exception of the carp, appear seldom to exhibit this phenomenon. Dr. Hulme has shown from experiments made on the post mortem luminosity of fishes, that the quantity of light emitted by fish after death is not in direct proportion to the degree of putrefaction, as was commonly supposed, but that, on the contrary, the greater the putrescence the less is the quantity of light emitted.|| Dr. Jacob has observed the luminosity of a fish to be bright enough to read a book by, placed near it, while as yet there was not the least putrefactive odour perceptible.¶ The phosphorescence of dead fish is imparted to the hand,

* "Phil. Trans.," 1667, vol. ii., p. 581; 1672, vol. vii., p. 5108.

† "Phil. Trans.," 1676, vol. xi., p. 599.

‡ "Phil. Trans.," 1800, vol. xc., p. 161.

§ Dr. J. Beal, "Phil. Trans.," 1676, vol. xi., p. 599.

|| "Phil. Trans.," 1800, vol. xc., p. 161.

¶ "Essay on Evol. of Light from Living Human Subject." Sir H. Marsh, 1842, p. 18.

or to clothes rubbed against them, and is not extinguished by water; it is diminished if the animal be placed in the receiver of an air pump, and the air exhausted, and is revived and increased in brilliancy by the re-admission of air into the exhausted receiver. A portion of a luminous whiting which the Hon. R. Boyle kept in an exhausted receiver for forty-eight hours, by degrees wholly lost its light, but recovered it again as soon as the air was restored.*

Human flesh has been observed to be phosphorescent *after* death, and also before death; the phosphorescence after death, as in the case of the phenomenon in the dead bodies of the lower animals, does not appear to have any connexion with the *advanced* stages of decomposition, nor has it, as far as I am aware, been observed in human flesh in that condition. Dr. Hart describes the luminous condition of human flesh as observed by himself, and remarks that the phenomenon has been noticed by Drs. Harrison, Jacob, and Houston.† “Having had occasion to enter the dissecting-room of the Park-street School of Medicine, on a dark, damp night in 1827, my attention was attracted by a remarkably luminous appearance of the subjects on the tables, similar to that which fishes and other marine animals exhibit in the dark. The degree of illumination was sufficient to render the forms of the bodies, as well as those of muscles and other dissected parts, almost as distinct as in the daylight. This luminosity was communicated to my fingers from contact with the dead bodies, from any part of which it could be removed by scraping it, or wiping it with a towel. I observed that the surfaces of the dissected muscles were brighter than any other parts. Although I have repeatedly visited the dissecting-room since, at all hours of the night, and at all seasons of the year, I have never since been able to discover a similar luminous appearance.” I may observe that, having long known of this observation of Dr. Hart, I have taken many and various opportunities of trying to see something similar myself, but have so far not been successful. The bodies of those who have taken phosphorus before death, or who have died from its effects as a poison, emit in the dark, from the various orifices, a luminous vapour so characteristic as to be regarded as pathognomonic of the poison. It does not appear that any experiments have as yet been made upon the degree and duration of the phosphorescence of the flesh in such cases, although the opportunities for doing so are not few, as it appears that at present phosphorus is the popular toxic agent upon the Continent; and Tardieu informs us that in criminal statistics phosphorus takes the first rank as a fashionable poison. Although in the case of post mortem phosphorescence, it is so frequently asserted that light is emitted from flesh, fowl, fish, and other meat, as that of lobsters, which is perfectly fresh, yet this assertion must be taken in a qualified sense. It cannot be denied that incipient decomposition

* “Phil. Trans.,” 1667, vol. ii., p. 581.

† Sir H. Marsh’s Essay, p. 20.

is present in such cases, because it is known that that process follows so closely upon the heels of life, that it is present and at work upon dead matter long before its presence is betrayed by those offensive products by which persons generally measure the progress of decay.

The evolution of light has been observed in cases where local decomposition was in operation upon the yet living body.* Quoy and Gannaid observed phosphorescence from the ulcerated back of a living turtle, from which the shell had been removed; several luminous points were plainly visible at night. It will be remembered that the carapace is often removed from these animals, for the sake of the tortoise-shell its outer layers yield, by the cruel process of lighting a fire on the reptile's back, the heat of which causes the plates of the dorsal shield to curl upwards, and separate more readily than they do in the ordinary process with a knife; they then return the animal to the sea, on the hopes that on some future occasion, when the shell has grown again, they may rob it a second time. A parallel instance of the phosphorescence of a part in which disintegration of tissue was taking place in the living human subject came under the notice of Dr. Stokes, and it is such a remarkable observation that I shall take the liberty of quoting it in his own words:—"When I was residing in the Old Meath Hospital, a poor woman, labouring under an enormous cancer of the breast, was admitted. The breast was much enlarged, and presented a vast ulcer with irregular and everted edges, from all parts of which a quantity of luminous fluid was constantly poured out. Upon being asked whether she suffered much pain, she answered, 'not now, Sir, but I cannot sleep, watching this sore, which is on fire every night.' I directed that she should send for me whenever she perceived the luminous appearance, and on that night I was summoned between ten and eleven o'clock, the lights in the ward having been then extinguished; she was sitting leaning forward, the left hand supporting the tumour, while with the right she every now and then lifted up the coverings of the ulcer to gaze on this, to her, supernatural appearance. The whole of the base and edges of the cavity phosphoresced in the strongest manner. The light was steady. I directed that the ulcer should remain open, while I retreated gradually, keeping my eyes fixed on the light, which I found distinctly visible at the end of the ward, which must have been more than twenty feet from her bed. The light within a few inches of the ulcer was sufficient to enable me to distinguish the figures on a watch dial. I have no very distinct recollection of the colour of the light, but I remember that its intensity was variable, it being on some nights much stronger than others."†

Coming to the subject of luminosity in living and healthy animals—to what may be called Physiological Phosphorescence—it will be found that this kind of phosphorescence is principally, but by no

* "An. d. Sci. Nat.," 1825, t. iv., p. 8, note.

† Sir H. Marsh's "Essay on Evol. of Light," op. cit., p. 54.

means exclusively, observed in certain of the marine invertebrata, and in the coleopterous order of the insect class. Among the marine Infusoria, the organism named *Noctiluca miliaris* possesses this property in an eminent degree, most of the orders of the classes Hydrozoa and Actinozoa, but especially the orders Sertularidæ, Physophoridæ, Medusidæ, Lucernaridæ, Aleyonaria, and Ctenophora. Many of the Annelids emit light; the Nereidæ are particularly noted for this property, also species of Syllis, Polynœe, Chætopterus, and Sabella. In the Myriapoda we have the *Scolopendra phosphorea*, and *Geophilus*, a genus of luminous centipedes, some of which are by no means scarce in this country; there are examples of luminosity among the Arachnida, Crustacea, and particularly among the Insecta. Several of the mollusca are luminous. The luminosity of living fish is thought by some to be due to an excitement of the phosphorescence of the sea by their rapid motion through the water; by others it is attributed to the adhesion to their bodies of some of the smaller luminous organisms. Pliny* speaks of a fish known as *Lucerna*, or the lantern fish, because it thrusts from its mouth a tongue that shines like fire, and emits a most brilliant light on calm nights; but Cuvier considered that the *Pyrosoma*, one of the Mollusca, is the luminous animal alluded to. Mr. Bennett, in a Paper read at the Zoological Society of London, has described some fish of the *Scopelus* family taken near Cape Horn which emitted vivid phosphorescent light from various parts of the body; the luminosity entirely disappeared upon the death of the fish. As we rise in the scale of creation instances become rarer of vital luminosity under ordinary conditions, and we are obliged to end with a mere reference to the statement of Azara that the urine of the Skunk is habitually luminous.

The presence of the *Noctiluca miliaris* is one of the causes of the phosphorescence of the sea—a phenomenon which is observed, though a less splendid degree, in cold and temperate latitudes as well as within the tropics. This organism, from the simplicity of its structure, is classed among the Protozoa, yet its light-producing power ranks among one of the most subtle problems of nature. M. Suriray, a doctor of medicine, while investigating the cause of the phosphorescence of the sea water at Havre, appears to have been the first who observed, and called attention to, the genus *Noctiluca*, which he described and figured in the Memoir which he communicated to the class of Sciences of the French Institute. In size the *Noctiluca miliaris* varies from .04 to .01 of an inch; so that a single drop of sea water may contain one or several individuals, and when they are numerous the water may assume the appearances of a phosphorescent solution. By filtering this phosphoric water, these organisms can be arrested and retained for examination; the water which has passed through the filter has lost its luminous property, which can be restored to it at

* "Hist. Nat.," lib. ix., c. 43.

once by replacing in it some of the *Noctiluca* which had been removed from it by filtration. Infusoria, of the genus *Peredinium*, contribute to the phosphorescence of the Baltic Sea. Some fresh-water Infusoria are also possessed of luminous properties. Sir Philip Crampton observed phosphorescence in the water of Lough Bray, and the surface of a piece of muslin through which some of the water of the lake had been strained presented a luminous appearance.* The light emitted by *Noctiluca miliaris* appears to be the combined result of a rapid succession of vivid scintillations, differing in this respect from the steady glow of posthumous phosphorescence in fishes. No photogenic apparatus, or special organ for the production of light, similar to that which is observable in luminous insects, is discernible in the simple organisms of the Infusoria; every part of the structure seems to have the power of emitting a nebulous light, resolvable with high magnifying powers into an infinite number of sparks. There is no sensible development of heat, no evidence of any secretion of a luminous mucus, nor does the emission of light appear to be connected with combustion of any kind;† sulphuretted hydrogen passed into the water, or a few drops of ether dropped upon it instantly destroys the luminosity of the *Noctiluca*. Another cause of the phosphorescence of the sea is the luminosity of various orders of the Hydrozoa and Actinzoa, especially of the order Medusidæ. According to Ehrenberg, the Arabians on the Red Sea name the entire family of Medusæ "Sea Candles" (Kandil el Bahr); and Spallanzani observes that the luminous Medusæ are called by the same name in the Lipari Islands (Candelliere di mare). Dr. Macartney‡ was inclined to attribute the principal portion of the phosphorescence of the sea around our own islands to a species of *Medusa* of very small size (*M. scintillans*), first described by himself, and which are frequently present in these waters in great abundance. On one occasion he separated a pint of these Medusæ from a gallon of sea water by straining through a cloth. He observed these Medusæ to continue to emit light when put under the receiver of an air pump, notwithstanding complete exhaustion of air, and he satisfied himself that the light was by no means of the nature of phosphorus, as it was often most strongly shown when excluded from oxygen gas; when electrical shocks were transmitted through a collection of them, they were excited, and shone with great brilliancy. Dr. Macartney's observations were communicated to the Royal Society in 1810. Many of the fixed Hydrozoa are endowed with phosphorescent properties, several of our native Sertularidæ glowing when irritated with greenish light, like that of burning silver. In a foreign species, Darwin§ observed that the flashes of light *always* proceeded up the branches, from the base towards the extremities, as often as he rubbed any part of a branch. The Sea-pens exhibit a beautiful phosphores-

* Sir H. Marsh, op. cit., p. 24.

† Quatrefages, "An. de Sci. Nat.," 1850, 3d ser., t. xiv. p. 236.

‡ "Observations upon Luminous Animals," Phil. Trans., 1810, p. 258.

§ "Naturalist's Voyage round the World," p. 202.

cence, which, as Forbes observed, when excited by shock, sparkles onwards from the portion struck in an upward or distal direction, still, however, continuing to be emitted from the point of prime contact. Of one of this group (*Renilla*) Agassiz remarks that "it shines at night with a golden-green light of a most wonderful softness; when excited, it flashes up more intensely, and when suddenly immersed into alcohol throws out the most brilliant light." Several of the *Ctenophora* are phosphorescent. Specially distinguished for its luminosity is the *Cestum veneris* of the Mediterranean Sea, which has the form of a band of more than five feet long and two inches broad, gleaming at night like a ribbon of flame as it moves beneath the surface of the water. Various genera of the family *Beroidæ* are also possessed of luminous properties. Among the marine *Mollusca* are found some of the most splendid instances of luminosity. The *Pyrosoma*, or Fire-body, is one of them; it is one of the compound ascidians, and forms a cylinder six or seven inches in length, open at one end, at the other closed, and bluntly rounded off. Mr. F. D Bennett* observed that when a *Pyrosoma* was taken into the hand out of a bucket of sea-water, the whole mass became instantly illuminated by myriads of bright dots, much resembling in hue the points on the elytra of a diamond beetle (*Curculio imperialis*). The *Pyrosoma*, enveloped throughout its whole extent in a flame of bright phosphorescence, shed sufficient light to render objects distinctly visible in every part of an otherwise dark room. The light appeared to be chiefly emitted from small specks of a brown or red colour, embedded in the parenchymatous structure of the body, and intermingled with the prominent rigid and pearly tubercles which stud the surface of the mass. No light was emitted after the death of the animal; no luminous matter was communicated from the surface of the *Pyrosoma* to any fluid or solid in contact with it, and the brown specks did not emit any light after their removal from the body. Friction at one point of the *Pyrosoma* induces the light at that point, and from thence the phosphorescence spreads over the whole mass, while the creature is quite freshly taken; afterwards the illumination arising from friction is only local.† The various forms of *Salpa*, another ascidian Mollusk of gelatinous consistence, possesses luminous powers. One of the Pteropodous Molluscs (*Cleodora cuspidata*) emits a speck of delicate blue light, which shines through the apex of its extremely thin and glossy shell.

Two principal kinds of phosphorescence of the sea have been observed—one in which the surface appears studded with scintillations of a most vivid description, upon any agitation of the water; a heavy tropical shower, for example, is said to produce a gorgeous effect at night upon the sea, when it is in this condition. This kind of phosphorescence is assigned by Mr. Bennett to the presence of the luminous

* "Proc. Zool. Soc. Lond.," 1833, Pt. 1, p. 79.

† Huxley, "Phil. Trans.," 1851, p. 580.

Infusoria, such as the *Noctiluca miliaris*; the other kind of phosphorescence observed is an appearance upon the sea of sheets or trains of whitish or greenish light, often sufficiently brilliant to illuminate the sails and deck of a passing vessel, to permit of print being read near the stern cabin windows, to show night birds hovering over the water in search of prey. This luminosity is produced by the presence of vast numbers of light-producing *Acalephæ* and *Mollusca*, by various species of *Beroæ*, *Medusæ*, and *Salpæ*, which are often congregated in such multitudes, that a ship sailing rapidly may continue during the entire night to pass through extensive fields of these floating and glowing organisms. The phosphorescence of the sea has a close connexion with the abundance of organic beings; in parts of the ocean where they are scarce, this phosphorescence is more rarely and less brilliantly seen. Occasionally, when they abound to such a degree as to make the water gelatinous, the sea at night takes the appearance of a plain covered with snow, or of an ocean of milk. Besides these surface animals, there are sources of illumination of the sea often at considerable depths, such as the great *Medusa pellucens* discovered by Sir Joseph Banks, which, with a disc six inches in diameter, shines like a globe of fire. Darwin* mentions that near the mouth of the Plata he observed some circular or oval patches at a considerable depth, from two to four yards in diameter, and with defined outlines shining deep down in the water, with a steady but pale light, while the surrounding water only gave out a few sparks. The appearance resembled the reflection of the moon, or some luminous body, for the edges were luminous from the undulations of the surface. The ship, which drew thirteen feet of water, passed over without disturbing these patches. An animal which is one of the fixed sources of the luminosity of the sea is the conchiferous Mollusk, the *Pholas*, or stone-borer, edible, and reputed to have an agreeable taste, with a flavour of pepper. One species, *P. costata*, is sold in the market at Havannah as an article of food. Pliny† was aware of the phosphorescent properties of this shell-fish; and in his chapter on the marvellous properties of the *Dactylus*, remarks that it is the peculiarity of these fish to shine brightly in the dark, when all other lights are removed, and the more moisture they have the brighter is the light they emit. In the mouth even, while they are being eaten, they give forth their light, and the same, too, when in the hands. The very drops, in fact, that fall from them on the ground, or on the clothes, are of the same nature. Beccarius, who tried numerous experiments upon the *Pholas*, found that of all the liquids into which he put the *Pholades*, milk was rendered the most luminous. A single *Pholas* made seven ounces of milk so luminous that the faces of persons might be distinguished by it. He also states that when the animal is preserved in honey, the property of becoming

* "Naturalist's Voyage round the World," p. 163.

† "Hist. Nat. Lib." ix., cap. 87.

luminous would continue longer than a year, and then it would, when plunged in warm water, give as much light as ever. Many of the Annelids, both terrestrial and marine, but especially the latter, are phosphorescent. The genera of *Nereis*, *Syllis*, *Polynoë*, *Choetopterus*, and *Sabella*, possess this property. Dr. Allman, many years ago, brought before the Natural History Society of Dublin a notice of the fact, new at the time, that a small Annelid possessed of luminous powers is frequently found in turf. He observed in the month of September that some of the turf bogs in the western parts of the county of Cork exhibited by night, on the recent removal of their surface, a great many minute luminous points, presenting almost the appearance of the sea when its waters are agitated during the night. This appearance was very transitory, lasting but for a few seconds after the exposure of the subjacent peat, and requiring for its subsequent manifestation a second removal of the surface. On bringing home some of the luminous peat, and making a careful examination of it, he found that this interesting phenomenon was caused by a small white setigerous Annelid, about half an inch in length. The power of emitting the light appeared voluntary, and to require for its manifestation that the animal should in some way be irritated. On holding one of them over alcohol, an exceedingly brilliant phosphorescence would take place, and last for a few seconds, excited, doubtless, by the irritation of the alcoholic vapour. This phosphorescence consisted in a very beautiful clear green light, and did not appear to be confined to any particular spot, the entire animal appearing luminous. He found upon inquiry that the phosphorescence of the bogs was well known to the country people of the western part of the county of Cork, though not referred by them to this cause. The cause of the phenomenon was a small white Annelid about half an inch in length, and composed of a number of setigerous rings, very distinct after the animal has become contracted from immersion in spirits. Each ring bore a fasciculus of very minute setæ on either side, requiring, in order to render them visible, a very high magnifying power. Duges has described a luminous Annelid, which he called *Lumbricus phosphoreus*, found by him in the tan of the hot-houses in the Botanic Garden of Montpellier. And it is not improbable that the phosphorescence of the turf-mould in Staffordshire, alluded to by Dr. Plot, may have been due to an analogous cause. A common centipede, the *Geophilus phosphorea*, is one of the phosphorescent Myriapoda. This centipede has been discovered in considerable numbers on the Hill of Howth by Dr. Stokes, who drew Dr. Allman's attention to its presence there, and is very generally distributed throughout the country. Fearing to be wearisome, I shall not go through the luminous genera of Crustacea, and shall conclude with a brief reference to the phosphorescent phenomena exhibited by insects. In the Hemipterous order of this class (Insecta), are the lantern and candle flies, whose luminosity has been very much questioned, but it is now pretty generally believed that they are luminous, but not equally so in both sexes, and not continually so, but occasionally or periodically.

The Coleopterous order includes the principal examples of phosphorescence,—the glowworms and the fireflies; both sets of insects (notwithstanding their names) are beetles of the same *Elater* family; the most brilliant fireflies are inhabitants of the hot and temperate regions of America. The glowworms are found in England, France, Germany, Italy, and other parts of Europe. The glowworms belong to the genus *Lampyris*, of which there are about two hundred species all more or less luminous: of the genus *Elater*, to which the firefly belongs, there are at least seventy species, and probably many more, with both sexes equally luminous. The word glowworm has arisen from the vermiform aspect of the female of the British species, *Lampyris noctiluca*, which is apterous and not very locomotive. Aristotle was aware of this fact, as he says—ants for example are both winged and apterous, and so is the glowworm.* In other continental species both sexes are winged. The males of the British species are but feebly luminous, and that only at the pairing season; those of the continental and foreign species are phosphorescent at all times. The luminous organs of the various species of *Lampyris* are of a special nature and well defined, not to be confounded with the intervisceral adipose substance, and present a determinate form, size, and position; presenting in the females of *L. splendidula* (the German species) four or five pairs of lateral organs of the form of flattened globules, situated on the abdominal segments from the first to the sixth rings. The luminous organs consist of an investing membrane enclosing a parenchyma of cells, tracheæ or air tubes, and nerves; the cells are of two kinds, white and pale, and it is in the contents of the *pale* cells the proper luminous substance resides; it corresponds in its microscopical reactions with an albuminous material, but owing to the extremely minute quantity of the substance which can be obtained, it has been impossible, as yet, to subject it to a more satisfactory chemical examination. All endeavours to detect the presence of phosphorus in the luminous organs have been fruitless. The organs of thirty males of *L. Splendidula* were treated with sulphuret of carbon, and when this was allowed to evaporate on blotting paper no luminosity was evident, nor was the paper charred. When organs which have been isolated by dissection are treated with nitrate of silver no black precipitate is formed. The luminosity is dependent upon the will of the beetle, and exists by day as well as at night, though very frequently absent in the day time, simply from the fact that these insects are nocturnal in their habits, and usually lie concealed in the dark during the day. Many irritants exercise an influence upon the production of the light, but the most powerful excitant is caustic potash, in all degrees of concentration, from 7 to 50 per cent. Luminous glowworms, especially the females, moistened with a solution of salt, placed with the cephalic and caudal extremities on the cushions of Du Bois's current apparatus, have de-

* "Hist. An.," lib. iv., cap. 3.

flected the needle of the multiplier from 3° to 7° , the head at the same time appearing to be positive. Non-luminous insects, even when they moved on the cushions, usually afforded, with a multiplier of 16,000 turns, no indication whatever of a current, or, at most, did not deflect the needle more than 1° or 2° . * From the foregoing experiments, coupled with the anatomical facts, Kölliker concludes that the luminous organs in the genus *Lampyris* are a nervous apparatus, whose nearest analogues might be sought in the electrical organs, and that the luminous matter, which is of an albuminous nature, and is abundantly supplied with oxygen by its numerous tracheæ, undergoes during life a decomposition, one of the ultimate results of which is urate of ammonia, which is found to be contained largely in the white cells. The luminosity of *Lampyris* is quite hereditary, for the eggs and larvæ are phosphorescent, as well as the perfect insect. If the luminous matter be extracted from its receptacle, the part heals and becomes filled again with a fresh supply. M. Moren,† Professor of Botany in the University of Liège found that when the spiracle next to the luminous material in *L. Noctiluca* is closed, the light is immediately extinguished, and reappears when it is opened, as the trachean ramifications which surround the luminous matter issue from a spiracle situated immediately at the side of the luminous mass.

The light of the phosphorescent Elateridæ of America, which is emitted from three principal points, has been examined with the spectroscope, but as yet without increasing our knowledge of the phenomenon. The spectrum produced by the firefly of New Hampshire was perfectly continuous, without traces of lighter or darker lines, extending from a little above Fraunhofer's line *C* in the scarlet to about *F* in the blue, gradually fading at the extremities. The spectrum of their light is continuous, without any black rays; it differs from the spectrum of the solar light merely by a greater intensity of the yellow colour. It is considered to be probably produced, as in *Lampyris*, by the slow combustion of a substance secreted by the animal. The splendour of the light can be decreased or diminished, at the will of the beetle, by means of membranes which it interposes like screens in front of the phosphorescent lamps which it has on, what is popularly called, its forehead. Professor Van der Hoovent‡ of Leyden got possession of an *Elater noctilucus*, which had been imported in a cargo of logwood, after it had lived some weeks in other hands; he kept it alive for a fortnight. The phosphorescent spots were, in the dark, first blue, then emerald green, then incandescent. Large printing could be read by the light, but it was necessary to carry the insect along the lines to read continuously. In their native country, on a dark night, their light can be seen at about 200 paces distant. In oxygen gas the lumi-

* "Quart. Jour. of Microscop. Science," 1858, vol. vi., p. 166.

† Kirby & Spence, "Entomology," 7th ed., p. 512.

‡ "Handbook of Zoology," vol. i., p. 526.

nosity was not more splendid. Experiments to determine whether the temperature rose with the phosphorescence were interrupted by the death of the animal. On dissection, nothing peculiar was observed beneath the spots on the thorax, except large or smaller masses of the adipose body connected by numerous tracheæ. The two spots on the thorax, through which the light issued, though destitute of the brown colouring matter, and therefore translucent, were of the same thickness as the neighbouring integument. Does this thickness, he asks, account for the transmission of the green light, whilst that which proceeds occasionally from parts of the inferior surface, where the membrane is thin, is yellowish?

It is a remarkable fact how seldom a red light is emitted from luminous animals; green, blue, white, yellowish, and various shades of these colours, are the ordinary tints of their phosphorescence. In the case of a strange coleopterous larva of Brazil, lights of two colours are produced—red from the head, and green from the sides.* The light of luminous animals has been observed to become red as they were about to die. Darwin remarks that in all the different kinds of glowworms, shining elaters, and various marine animals which he has observed, the light has been of a well-marked green colour.

The wide distribution of a vital luminous property throughout the animal kingdom may be gathered from the long list of animals which have been ascertained to be possessed of it, and probably the catalogue will be greatly enlarged in the progress of future investigation.

The objects of this luminosity are probably various—to some animals it is protective and a means of defence. A carnivorous beetle has been seen walking round a luminous scolopendron, apparently deterred from attacking by the brightly-shining light. When M. Quatrefages was one night prosecuting his investigations on the phosphorescence of the sea at Boulogne, a dog came down to the edge of the water, and barked at him in his boat. A can full of water thrown upon the sea in the direction of the dog, caused such a blaze of light, that the animal ran howling away, probably mistaking it for fire. Another object of the light is sexual attraction: the apterous female of our English glowworm beacons the male to her by it. Dr. Browne, in his "History of Jamaica" (1789, p. 433), describes the mode in which the negroes hold a firefly, or even a lighted stick, between their fingers, and wave it up and down, so that it may be seen by others (fireflies), who, taking it for some of their kind, fly directly towards it, and pitch upon the hand, unless they discover the deceit before they come too near. In other animals the luminosity appears to be an inherent quality, inalienable from their organism as long as their vitality is preserved.

The nature and the cause of the luminosity of living animals, of physiological phosphorescence, cannot be yet precisely stated. To some it is not satisfactory to assert that it is phosphorescence, or an evolution of light from a body which undergoes thereby no loss of substance,

* "Trans. Ent. Soc.," N. S., vol. iii., p. 5 (Proc.).

and which is the same at the end as it was at the beginning of the process; and others are equally displeased with the suggestion that it is dependent upon a direct conversion of vital force into light. In some cases chemical action goes far towards the explanation; but the more this subject is studied, the less inclined will one be to advance any positive opinion upon its cause and nature, and the more convinced will they become that animal luminosity is one of the most subtle and marvellous phenomena of nature.

[The following Paper "on *Orthogoriscus oblongus*" (the oblong sunfish), read by Mr. Andrews at a meeting of the Natural History Society, 14th of November, 1845, and hitherto unpublished, is here inserted in accordance with an order of the Council that it should appear in this volume of the "Proceedings," with a coloured drawing of the fish.]

Among the donations that are this evening to be acknowledged, I may take the opportunity of making some general remarks upon the oblong sunfish, *Orthogoriscus oblongus*. It was taken in the early part of last month (October, 1845), at Tramore, near Waterford, and secured to the ichthyology of this country, through the vigilance of a member of the Society, Dr. Farran, a naturalist ever most active in promoting the knowledge of, and investigating the natural history of his native country. This fish has, through his kindness, been presented to the Society, a valuable addition, indeed, to the Museum, to be placed with the other fine species in the Society's collection, the short sunfish, *Orthogoriscus mola*.

I have, however, to express my extreme regret that the circumstances under which it came into my possession, prevented an examination of its characters until decomposition had almost obliterated its internal organisation. A beautiful and accurate drawing had been made before its external characters or any change of their true features were lost.

As far as I have been enabled to trace, this appears to be the fifth occurrence of the capture of this fish on the coasts of Britain. Dr. Borlase is mentioned as having been the first who described it as British, noticing, in his "Natural History of Cornwall," a specimen from Mounts Bay, and he also describes one of large size taken near Plymouth, in 1734, which weighed 500lbs. Donovan has figured in his "Natural History of British Fishes" a small specimen obtained in the Bristol Channel, and from which Mr. Yarrell's figure in his "History of British Fishes" is copied. The fourth specimen on record is that described by Mr. Couch, in the sixth volume of the "Annals and Magazine of Natural History," taken at Par, in Cornwall, in September, 1840.

The oblong Sunfish, together with its allied species, the short Sunfish, belongs to the order *Plectognathi*. The principal distinctive characters are the maxillary and intermaxillary bones being firmly attached or soldered as one entire piece, forming an immovable jaw, con-

nected with the palatine arch, which, by a suture, is united to the cranium. The *Orthagoriscus* forms a section or sub-family of the *Gymnodontes*, by having no apparent teeth, the jaws being furnished inside with an ivory-like substance, divided into laminae, and which, according to M. Cuvier, are essentially true teeth united. The specific characters of this very rare and singular species are distinct from those of *O. mola*, by the oblong form of body—the pectoral fins being pointed, the skin being perfectly smooth and divided into irregularly-formed hexagonal compartments, the sutures of which fit smoothly to each other, the caudal fin being truncate or square, not rounded—this true caudal fin being immediately connected with the dorsal and anal fins. Its measurements are—

From snout to extremity of caudal fin, . . .	23 $\frac{1}{2}$ inches.
Breadth from mesial line on the back to abdominal edge of the belly, ...	13 $\frac{1}{2}$ „
Length from snout to the eye, ...	3 $\frac{1}{4}$ „
Do. to anterior base of pectoral fin, ...	9 „
Do. of pectoral fin, ...	5 „

The dorsal and anal fins are long and gradually tapering—

Extreme breadth of dorsal at the base, . . .	3 $\frac{1}{2}$ inches.
Length of do., ...	7 $\frac{1}{4}$ „
Anal fin, extreme breadth, ...	3 „
Do. in length, ...	6 $\frac{1}{2}$ „
Breadth of caudal fin, ...	8 $\frac{1}{4}$ „
Depth of do., ...	1 $\frac{3}{4}$ „

The number of fin rays are—pectoral, 13; dorsal, 18; anal, 17; caudal, 19; probable weight, when captured, 16 lbs.

The colour of the back was of a dusky amber brown, in the lighter shades or variegations of which the hexagonal plates of the cuticle are strikingly seen: the sides silvery white, marked from the mouth with double lines of waved stripes pointing downwards, and which assumed a maculated appearance, passing into fainter lines beneath the pectoral fins; abdomen dusky brown, becoming of a beautiful pink or flesh colour around the anal and urinary vents; aperture of the eyes nearly round, 1 $\frac{1}{2}$ inches in breadth; iris silvery white, pupil dark and prominent, protected by a nictitating membrane; branchial orifice or spiracle small, semilunar, placed immediately anterior to the base of attachment of the first pectoral ray.

Of its internal organization I regret that the opportunity was lost of examination. Its state of decomposition was such, on being opened, that it was not without much difficulty and care its skin was preserved in a perfect state. The internal skin covering the body was formed of a pale flesh-coloured tissue, the colour being uniform throughout, and although extremely thin beneath the eyes, and anterior to the pectoral fins, yet showing no trace of the waved lines that marked the external cuticle, and which were confined to, and appeared the permanent mark-

ings of the plates that formed the cuticle; thus evidencing that no physical changes in the fish could have been accessory to the creation of these markings that in the recent state were as vivid and as beautiful as the drawing actually delineates. This internal tissue from the pectoral fins to the tail became extremely thick and tough, necessarily so where the more powerful display of muscles and action existed. Thick layers of flesh surrounded the spinal column, the spine being prolonged into a series of vertebræ, terminating in simple coccygeal vertebræ. The dorsal and anal fins were supported by a series of bones, which pass into the spinous process; the bones of the anal fin were particularly strong, requiring some exertion to sever; the cartilaginous caudal fin rays were supported by semi-osseous interspinous processes; these three fins exhibiting a powerful development of muscles for their action. The rays of the caudal fin bifurcate in a beautiful and regular manner into finer filaments, to the margin or extremity of the fin. Beneath the spinal column no air bladder could be detected. The opercula and branchial rays, and a great portion of the liver, which appeared to have been large, were in such a state of decomposition that no further investigation could be proceeded with.

My friend, Dr. Bellingham, has been the first to detect and to remark in the *mola* the movable proboscis which projected beyond the upper lip. In the *oblongus* the snout appeared formed of a cartilaginous process, the upper lip having a fold, and apparently possessing mobility and great sensitiveness, being largely supplied with nerves. In the *Lophidæ*, the Anglers or Frog-fish, the several long tentacula from the top of the head are organs of great sensibility; the same are seen most remarkable in the *Siluridæ*, or Cat-fish family; these cirri being analogous to the tentacula in the *Acalephæ*, and to the antennæ in certain insects. I have observed as to the prominent form of the eye in the *O. oblongus*. In the projecting or very convex cornea it would seem that it was afforded a kind of periscopic vision, and which is a necessary power to animals whose movements must be decidedly slow. Fish which remain constantly at any great depth at the bottom have generally very prominent or large eyes. In the *O. mola*, Dr. Bellingham has noticed a membrane covering the cornea, similar to the *membrana nictitans*.

The late Rev. Lansdowne Guilding, who held the office of Colonial Chaplain at St. Vincent's, and for whom as an accomplished naturalist the highest respect must be entertained, has described a new genus of the Sunfish tribe, of gigantic size, inhabiting the seas of the West Indies, which has been named *Pedalion gigas*. Guilding first observed the remarkable characters in the eye of the Sunfish, its construction being conical and versatile, enabling the fish to look different ways at one time, or to have an exceedingly wide range of field. He has observed this species to exhibit during the night a splendid phosphorescent appearance. The same is mentioned as having been noticed in the *O. mola*, and in the *oblongus*.

In the characters thus drawn of this rare species we necessarily look to the analogies or connecting links with the families or groups in the

order *plectognathi*, or cheloniform fishes, in which it has been placed. With the Balistidæ, it is connected with *Ostrasinæ* in the character of the plates of the cuticle, which, similar to the Ostracian or Trunk-fish, are, instead of scales, composed of plates joined together. The European File-fish* (*Balistes capriscus*), which has been taken off the coast of Sussex, exhibits an arrangement covering the body of hard rhomboidal imbedded plates. To *Tetraodon* and *Diodon* it is related by having no true teeth, and to the *Syngnathidæ*, or Pipe-fish, by the versatile structural arrangement of the eyes. The *Syngnathus*, however, more properly belongs to the *Lophobranchii*.

Dr. Bellingham's excellent description of *Orthagoriscus mola*, in a paper read at the meeting of the Society, in April, 1840, and published in the "Magazine of Natural History" of that year, clearly shows how very distinct are the characters he has described from those I have given of the *Oblongus*. In the latter the form of the pectoral fin, the hexagonal compartments or plates on the surface of the body, and possessing a true caudal fin with rays, show such important deviations that I am inclined to consider the generic name, *Cephalus*, as applied by Shaw and Swainson, to be more appropriate than being continued with the genus *Orthagoriscus*. The *Mola* seems much nearer allied to *Pedalion* of Guilding in the rough granulated surface of the body, the short, rounded, pectoral fin, and more particularly in the lobed sacral appendage, serving instead of the caudal fin. In *Pedalion* the lobes are described as six in number; in *Orthagoriscus mola* they are eight to nine. In this respect the figures given in the several works on British fishes are very inaccurate.

Mr. Couch has remarked of the *Mola* taken on the Cornish coast, that in calm weather it mounts to the surface, and lies, perhaps asleep, floating with the tide, with its head and even its eyes above water; but that he has known it when attacked to make awkward efforts to escape, bending and directing its motion in various ways. Dr. Neil states that one brought to him made no efforts to escape, but suffered one of the sailors to put his hands under it, and lift it into the boat, so stupid the fish appeared. In the several statements it does not appear that the fish made any attempts to descend.

Dr. Farran is of opinion that this action of floating on the surface could not have been one of rest or enjoyment, but that the creature must evidently have been in a dying state. Mr. Robert Ball has stated that between the years 1818 and 1825 he saw five of these fish off the coast of Youghal. There were three of them dead. *Diodon* and *Tetraodon* (the Globe-fish) have the power of inflating an extensile membrane sac, which adheres along the abdomen, and when thus distended, they roll over, and float with the stomach uppermost. They can as readily eject the air, render the membrane flaccid, and sink at pleasure. In tropical seas, Dr. Roget mentions that fish have been captured by having remained too long on the surface of the water, exposed to the

* Some taken in Galway, Dingle, and Brandon Bays.

burning rays of the sun. The fish finds itself retained against its will; the air bladder, becoming overdistended by the heat, resists the efforts of the animal to compress it. It thus continues floating until the cool of the evening condenses the air in the bladder, and restores the power of descending.

In *Orthogoriscus*, that possesses neither air bladder nor the power of inflating the body, the small size of the pectoral fins, and the dorsal, anal, and caudal fins, being merely organs of progression, it is natural to infer that—like *Pleuronectidæ*, or Flat-fish, and the *Lophidæ*, or Anglers—they have not the will nor the necessity to rise to the surface, but more likely to remain near the bottom, where *Crustacea*, *Mollusca*, and *Corallines* form their principal food. The Rays, which have powerful pectoral fins, are enabled by their considerable action to rise readily to the surface without the assistance of an air bladder. The formation of the caudal fin or tail is of much importance in determining the characteristic of the fish as to its swiftness or sluggishness of swimming. Thus the rounded form of the *mola*, and the truncate character of that of the oblongus, would prove them to be fish of slow movements. However, we cannot form conclusive views upon the habits of these ground-feeding fish; the most we can arrive at must be suppositions founded from observation on internal as well as external organization, and deduction from analogical reasoning.

One remarkable character, Mr. Swainson states, “that in the class of fishes, the shape of the pectoral and caudal fins are almost always symmetrical—that is, that the caudal fins are forked in the same proportion as the pectorals are pointed; nor does an instance at this moment occur to us where the pectoral fin is pointed and the caudal rounded, or the contrary.” Now it is very evident, in the instance of the *oblongus*, there is a departure from the views advanced by Mr. Swainson. Again, in the genus *Pecilia*, of South America, a similar character is seen. *Pecilia unimaculata*, observed by Mr. Darwin in fresh-water ditches at Rio Janeiro, and described in the zoology of the voyage of H. M. S. Beagle, has the caudal rounded, while the pectorals are narrow and pointed. *Tetraodon angusticeps*, inhabiting the Galapagos Archipelago, shows a beautiful radiating bifurcating of the rays of the caudal fin, resembling that of the oblongus.

Since this paper has been drawn up, Mr. Robert Ball, Director of the Museum in the University, has kindly informed me that in the Museum there is a specimen of the *oblongus*, which he suspects to have been sent there, with several rarities of birds and fish from Wexford, by the Rev. Mr. Elgee, about the year 1790.

Dr. Scouler then commented upon the admirable state in which Mr. Andrews had preserved the species of Sun-fish this evening exhibited, and he congratulated the Society upon the higher grade of views that Mr. Andrews had drawn of the characters and analogies of that species, with the other, the *Mola*—statements so superior to the mere describer of external form, or to the collector or noter of habitats. He did not agree with what Mr. Andrews

had, although cautiously, put forward, that the air bladder was of importance to the certain habits of fish. Eels, which were ground-feeding fish, had an air bladder, and he recollected that there were two species of the *Scomberidæ*, or mackerel tribe, that were so perfect a resemblance of each other, as one drop of water to another, yet one possessed an air bladder, while it was wanting in the other. With regard to the sensitiveness of the lips or mouths of fishes—this was peculiarly shown in the shark tribe. He considered that there was a great distinction between the characteristics of the imperfectly developed teeth of the *Mola* and of the *Oblongus*. In the former their strong formation evinced a capability of grinding and crashing the hardest *Mollusca*, while in the *Oblongus* the structure seemed fitted only to feed on the *Annelides*, *Holothuriæ*, and other soft-bodied creatures.

WEDNESDAY, JUNE 1, 1870.

WILLIAM ANDREWS, Esq., Vice-President, in the Chair.

The minutes of the previous Meeting having been read, confirmed, and signed,

The Chairman gave a short but most interesting paper on some rare Crustacea, obtained by dredging in from forty to sixty fathoms off the south-west coast of Ireland.

He exhibited a specimen of the long-legged swimming crab (*Portunus longipes*), dredged in upwards of fifty fathoms off the entrance of Dingle Bay. It is one of the Mediterranean species, and Mr. Andrews was not aware of its occurrence having been before noticed on the coast of Ireland. The specimen exhibited was not full grown, but possessed all the characteristics described by Bell and by Spence Bate. Its colour was of a deeper brown when first captured. The carapace exhibited the transverse ridge, terminating at each side by rather a long and sharp tooth.

Beautiful specimens of *Paguridæ* were taken in fifty fathoms, particularly *Pagurus ulidianus* and *Paguris lavis*. The latter were particularly fine, remarkable for their clear yellow colour, and having a distinct red mark extending along the hand and bifurcating at the fingers. A specimen laid before the Society had the ova fully developed; they had been found in that state early in August.

Mr. Andrews then gave an account of many other forms of the marine invertebrata procured by him while dredging in deep water in Dingle Bay, and off the Islands, amongst which he enumerated the following, viz.:—

Stenorynchus tenuirostris,
Inachus dorsettensis,
Pisa tetraodon,
 ——— *Gibbsii*,
Hyas araneus,
 ——— *Coarctatus*,

Maia squinado,
 Eurynome aspera,
 Pirimela denticulata,
 Portunus holsatus,
 Gonoplax angulata,
 Ebalia Pennantii,

—— Cranchii,

Corystes Cassivelaunus,

Pagurus Bernhardus, of large size, unprotected by shell.

—— Prideauscii,

Galathea Squamifera,

—— Strigosa,

—— Nesca,

Hippolyte varians,

Palæmon servatus, in 60 to 80 fathoms, also met at that depth in the stomach of the cod,

Pandalus Annulicornis, similarly met.

Gonoplax angulata was brought up with coarse sand in 40 fathoms, and Galathea nexa was frequent in 15 to 20 fathoms, among coarse shingle and nullipores.

DR. ARTHUR WYNNE FOOT then read the following

“ BRIEF NOTES ON ENTOMOLOGY.”

ON the 12th of April, 1870, I left town to spend a few days in the neighbourhood of the town of Graig-na-managh, in the eastern part of the county of Kilkenny; and with this date commenced my entomological season for the year. The record of my proceedings contains nothing that is very novel—at least so far as I have been able to identify my captures—and I only bring forward these observations because, from their practical nature, they are such as may be of use to those in pursuit of insects at a similar time of the year. Professor Wilson has accurately discriminated (see Christopher in his “Aviary,” Cant. i.) between the two orders of naturalists—those self-formed amongst the fields and forests on the one hand; on the other, the dry, sapless students of books in a closet or a museum. It is only for the former that these unscientific remarks can have any interest.

The afternoon of the 12th was so wet that nothing could be done but remain in doors, and unpack the *materiel* of insect warfare, set up land and water-nets, prepare laurel tins and spirit bottles. The 13th was also a very unfavourable day, rain falling almost without intermission, the wind S.W. In such weather dredging for water beetles can be resorted to, if you do not mind having to change your clothes; and a short examination of some of the back drains running parallel to the Barrow, above the town of Graig, produced a considerable number of the commoner Hydradephaga. I may notice that the advantage of a piece of indiarubber cloth for kneeling on while examining the contents

of the water-net is quite spoiled by heavy rain, which collects in pools on it, and makes it just as uncomfortable to the knees as the wet ground itself. The indiarubber cloth, so useful to coleopterists, may then be dispensed with if working in actual rain. The water-net used was one made by myself out of stout sampler canvas, stitched on a hoop, a foot in diameter, of stout galvanized iron wire; the net was lashed to the end of two joints of a salmon rod. I took up various species of newt—the great water newt (*Triton cristatus*), the smooth newt (*Lissotriton punctatus*), and the palmated smooth newt (*Lissotriton palmatus*). The newts were thrown back into the drains; the larger species of the water beetles—species of *Dytiscus*, *Acilius*, and many of *Ilybius*, were put into a half-pound tobacco canister, partly filled with crushed laurel leaves, but having at the bottom three or four broken slabs of cyanide of potassium loosely wrapped in blotting paper, which retains the moisture of the cyanide as it liquefies, and helps efficiently to make the confined atmosphere of the canister very deadly; but, notwithstanding, the raps of the beetles as they spring about can be heard for some time against the top and sides of their tin prison. The smaller water-beetles and smaller water-bugs were put into a wide-mouthed bottle of convenient size, nearly filled with methylated spirits of wine. This answers for killing and carrying safely all the smaller beetles. They are easily set at any time when taken out of the spirit, and do not run the risk of being mutilated by their stronger fellows, as they would in the tin canister. The only drawback that I know of is that the legs of insects thus preserved may prove more brittle than usual when set. I noticed that the aquatic coleoptera always died much more slowly in the spirit-bottle than the terrestrial beetles; perhaps from their being so much better accustomed to a liquid medium the shock of immersion was not so overpowering, and their respiration is less suddenly and less violently interfered with. The spirit-bottle will answer well for killing and keeping spiders, small ichneumons, and some flies—in fact those Hymenoptera and Diptera which have no considerable amount of pubescence. If there is much hairiness on any insect immersed in spirit, no amount of dressing will subsequently restore the natural lie of the down, and they can always be recognized as a drowned insect. Many *Coleoptera*, especially species of *Philonthus*, and many of the *Chrysomelidæ* and *Coccinellidæ* expand their wings when immersed in the spirit bottle. When this occurrence is objectionable, as many think it spoils the appearance of the insects, the wings can be easily pulled off by a smart jerk with a broad forceps when setting, and the elytra being put back in their places the absence of the membranous wings is not discoverable.

In the course of the day *Cidaria psitticaria* (the red-green carpet) was found in an orchard, dodging about among the apple trunks in a drizzling rain; it threw itself down on the ground when escape seemed hopeless, and gave up without any show of resistance. As the impregnated female of this moth hibernates, and the apple is a favorite food-plant of its larva, it is likely that the insect was engaged in laying. *Dromius*

quadrimaculatus was taken among the chinks of bark, where they subsist upon other subcortical insects and several species of *Coccinella*, *14-guttata*, *14-punctata*, and *variabilis*. The lady-birds, were no doubt; awaiting the visits of *Aphides* to the apple-blossoms just about opening; however, I did not see any aphides, though I on several occasions looked for them on the fresh young leaves and opening blossoms of the apple trees. On the 14th I saw the first white butterfly of the season, *Pieris napi* (the green-veined white;) *Anthocharis cardamines* (the orange-tip) was seen the same day. Many early spring bees of the genus *Andrena* were rolling themselves in the flower-heads of hawkweed. These bees are best killed by dropping a little chloroform through a hole in the lid of a small pill-box in which they have been enclosed one at a time. In a minute or two the bee can be pinned and put in the collecting box, where it will remain quiet, or at most only moving its legs slowly. Hymenoptera are not so easily killed with chloroform as the Diptera are. It is troublesome, unless collecting bees alone, to pill-box each separately, and carry them home to be killed there by the fumes of sulphur under a bell glass. On the 15th, in the sandy copse-wood of Coolreany, the green tiger beetles (*Cicindella campestris*) were flying about in the hot sunshine in the forenoon and middle of the day, lighting often, and running quickly along the road tracks through the wood. *Sphæcodes ephippia*, a small bee of the family *Andrenidae*, was found in same locality. *Meloe proscarabæus* (the oil-beetle) was met with in abundance, mostly females, slowly dragging their bloated bluish-black bodies after them. Orange-tips, green-veined whites, and one or two of the azure-blues (*Polyommatus argiolus*) were seen in the afternoon. Great numbers of the peacock butterfly (*Vanessa Io*) were met along the skirts of oak-woods, hibernated specimens; now and then a small tortoiseshell (*Vanessa urtica*), but none of the admiral (*V. Atalanta*); the hibernated specimens of the latter are seldom seen till May is well advanced. This evening I tried if anything was to be got by sugaring, but was most unsuccessful, as I had anticipated, from the wind having been in the east all day, and the evening being clear and cold, almost frosty. On the 16th, the orange-tips, (*Anthocharis cardamines*) were coming out very freely and quite fresh; the speckled wood butterfly (*Lasiommata Aegeria*) was seen for first time this season. I took a number of fine specimens of the long-legged *Hydrometra najas*, inaccurately called water spiders, in the brook in Borris Demense. Several pairs were *in coitu*—the smaller males retained their amatory clasp of the females even in death. On the 17th (Easter Sunday), I noticed great numbers of *Aphthona pseudacori*, most of them *in copula*, on the young yellow irides by the edge of the Barrow, hopping about like fleas if disturbed; also, took *Chlœnius vestitus* from under a stone by the edge of a stream. This evening, at 9 p.m., as the wind, which had been S.E. through the day, had fallen, and as the night was dark, I set the American moth trap, more as an experiment to see how the lamp would work than in the hopes of catching anything. This moth trap has been described by H. G. Knaggs, M.D., in the 2nd vol. of the "Etomologist's

Monthly Magazine," p. 199. I have used it on many occasions since this paper was read, and have never been rewarded by any captures worth speaking of. I had one of the large size sold by T. Cooke, for £2; as at present constructed it seems to me to have many defects.

On the 18th, I took a fine series of *Polyommatus argiolus* (the azure blue), among the holly bushes in the woods of Mr. Kavanagh and Col. Tighe, on both sides of the Barrow, below St. Mullins. All the specimens were males. These are the earliest of the blues, appearing in forward seasons about the end of April, but more generally in May. Its occurrence on the 15th and 18th of April is unusually early. In the "Ent. Month. Mag." for May, 1870, Mr. Nash, writing from Gloucester, records the appearance of *P. argiolus* on the 4th of April last year (1869); the earliest date at which he saw it was the 24th of April. The same day I took a fine specimen of *Bombylius major* sipping on the wing, like the humming bird moth, from the blossoms of *Caltha palustris*; also many oil-beetles, most of them *M. proscarabæus*. Two of these I pulled up out of holes in a hard pathway, down into which they were going head foremost. 20th. Dragged ponds and stagnant drains, getting many of *Nepa-cinerea* (the water scorpion), several species of *Corixidæ*, and many *Hydradephaga*. Sugaring this evening was very unprofitable, producing one very much worn specimen of *Scopelosoma satellitia* (the satellite moth), some *Helops striata*, and several specimens of weevils (*Alophus triguttatus*, *Otiorrhynchuspicipes*, *Strophulus coryli*). On the 21st swallows appeared in great numbers for first time this year; got *Anchomenus albipes* in great plenty, under stones in damp sandy ground, beside the edge of the river; also the pretty vermilion weevil, *Apion minutum*, among the roots of grass. The 22nd being wet and stormy, I spent some time searching cow dung in a sheltered paddock, and got many species of *Brachelytra*, especially of *Philonthus*, *Hister*, and *Sphæridium*. The cuckoo was heard this day for the first time this season. In the evening I tried sugaring again, with the same success as on the former occasion, getting only *Helops striatus*, and the same kinds of weevils as before; even the earwigs, ants, and woodlice were rather scarce at the sugared trees. The willow catkins were tried, but nothing moved near them, the night being clear, cold, and starry, no wind, but had been in E. all day. In the daytime, the sun being hot, the willow blossoms were much frequented by *Volucella bombylans*, many *Syrphidæ*, and the large hybernated females of *Bombusterrestris*, *lapidarius*, and *muscorum*, busy collecting materials for the use of their summer progeny. On the 23rd, while reading in a boat moored in the rushes by the water's edge, I took many pairs of *Prasocuris phellandrii* and *marginella* off the leaves of *Caltha palustris*; the males were all shorter and smaller than the females. A pair of *Silpha rugosa*, taken from underneath a dead lamb on the mountain side, was all I got the next day, before my return to town. The season was very backward in vegetation, and very late as concerned insects. The coldness of the nights made collection from the willow blossoms or by sugar almost a useless labour. The leaves were hardly visible on the hedges, so bush-

beating, unless for young caterpillars (very useless to a town entomologist), was out of the question. However, the enchantment of out-of-door entomology does not always consist in the number of rare things obtained, but is very much due to the recreation of an invigorating pursuit, and to the pleasant associations with which the observations of insect life are often connected.

WEDNESDAY, NOVEMBER 2, 1870.

WILLIAM ANDREWS, Esq., V. P., in the Chair.

The minutes of the last meeting having been read, compared, and signed,

The Secretary read the annual report for the past session, which was adopted unanimously. The Treasurer read the annual balance sheet of the Society for the past year, and reported a balance to the credit of the Society of £75 8s. 3d. In consequence of the voting list not having been sent down in time from the printers, the annual election of office-bearers could not be proceeded with.

It was proposed by Mr. R. P. Williams, and seconded by Dr. Macalister, that a meeting of the former Council should be held on that day fortnight, in Mr. Williams' house, No. 38, Dame-street.

The meeting was then adjourned.

WEDNESDAY, DECEMBER 7, 1870.

REV. PROFESSOR HAUGHTON, M.D., in the Chair.

Mr. R. P. Williams and Mr. T. Kift were nominated as Auditors of the accounts for the past year.

The Chairman having declared the meeting to be an emergency meeting, at which all by-laws were suspended, Mr. R. P. Williams proposed, and Mr. Barton seconded, the election of Mr. William Andrews and Mr. R. J. Montgomery as Secretaries to the Society for the coming year.

Lord Clermont was proposed as President of the Society by Mr. R. P. Williams, and seconded by Mr. Kift, and unanimously elected.

The following Vice-Presidents were duly proposed and seconded, and unanimously elected :—

Robert Callwell, Esq., M.R.I.A. ; R. P. Williams, Esq., M.R.I.A. ; W. Archer, Esq. ; E. Perceval Wright, M.D.

The following gentlemen were elected to form a Council :—

Robert Ball, M.A. ; Henry Barton, Esq. ; Alexander Carte, M.D. ; George Dixon, Esq. ; Arthur Wynne Foot, M.D. ; Rev. Dr. Haughton ; Archibald Jacob, M.D. ; Thomas Kift, Esq. ; John J. Lalor, Esq. ; Alexander Macalister, M.D. ; Robert M'Donnell, M.D. ; David Moore, Ph.D., M.R.I.A. ; Ramsay H. Traquair, M.D.

WEDNESDAY, MARCH 1, 1871.

REV. PROFESSOR HAUGHTON, M. D., in the Chair.

The minutes of the previous meeting having been read, compared, and signed, donations announced, and thanks voted,

G. H. Kinahan, Esq., read the following communication:—

ON FERNS OBSERVED IN IAR, OR WEST CONNAUGHT, AND ALSO IN SOUTH-WEST MAYO.

Polypodium phegopteris.—Abundant in Glan, on a sloping tract of ground south of Maum Bay, or the N. W. arm of Lough Corrib; in county Mayo, found in the Coom, S. W. of Dromin Chapel, and said to be found at Toormakeady, west of Lough Mask.

Polystichum aculeatum, with varieties *lobatum*, and *lonchitidoides*.—Found in favourable situations in the vicinity of Lough Corrib, growing more especially in the metamorphic limestone; also at Glengowlagh, west of Oughterard.

Lastrea montana.—On the north and north-east slope of some of the hills south of Maum Bay, and at Lenane, Killery Bay.

Asplenium viride.—On limestone, above 1,000 feet high, on Lisoughter, and in Glenlosh; on serpentine and steatite on Bengower, one of the Twelve Pins; and on steatitic-dolomite, above 1000 feet S.W. of Dromin Chapel, county Mayo.

Asplenium adiantum nigrum.—A beautiful bushy variety found on serpentine, S.W. of Glendalough Hotel; the variety *acutum* not uncommon.

Ceterach officinarum.—In places abundant on the carboniferous limestone, but only locally found; on other limestone and calcareous rocks rare.

Adiantum capillus veneris.—Found on the hill N.N.E. of Sheffey, county Mayo. This locality is five miles away from the nearest salt water (east end of Killery harbour), and is the most northern station yet known in Ireland. Only a few small stools could be found. The lobes of the pinnules are very deeply serrated.

Cystopteris fragilis.—Found in two places on limestone, about 900 feet high, in Glan, N.W. of Oughterard.

Botrychium lunaria.—Found on some of the drift hills near Lough Corrib, and near the sea shore six miles S.W. of Louisburgh, county Mayo.

Ophioglossum vulgatum.—Growing freely in a few stations on the coast of Galway Bay, in places where the soil was formed of shell sand; also in a few scattered localities, limy soil.

Lastrea dilatata.—Common, more especially the small mountain variety, *aspedium dumetorum*.

Athyrium Filix-fœmina.—Not uncommon; a short bushy variety,

somewhat like *Polypodium alpestre* in appearance; abundant in some localities.

Hymenophyllum Tunbridgense.—Not uncommon on the silicious rocks; very abundant south of Killery harbour.

H——— unilaterale, rarer than *Tunbridgense*, grows in similar situations.

These are only a few of the plants selected from Mr. Kinahan's paper, upon which the Chairman and Mr. Andrews made remarks as to its extreme interest, bearing upon the geological characteristics where the plants were distributed, and where they were extremely local.

The variety of *Adiantum capillus veneris* is a beautiful plant. A more northern locality than that described by Mr. Kinahan of the *Adiantum capillus veneris* was found by the late Right Hon. John Wynne, in Leitrim, on the borders of Sligo.

Mr. WILLIAM ANDREWS, M.R.I.A., then read a paper:—

NOTES ON THE ICHTHYOLOGY OF THE SOUTH-WEST COAST OF IRELAND.

IT is always of interest to bring to notice any new facts, either in zoology or botany, of a county or district, but more especially so when any discovery can be recorded which presents new features of animal or vegetable life, the existence of which had not been previously known.

The chief remark conveyed in this Paper is with reference to the capture, in January last, on the south-west coast, of several specimens of a fish of extremely rare occurrence—the *Trichiurus lepturus*.

When first it was met with by Dr. Busteed, cast ashore after a gale of wind, he conceived it to be a species of the scabbard fish, *Lepidopus*, the terminal portion of the tail or filament having been torn off. Its formidable jaws, and the pectoral fins pointing upwards, led him to that conclusion.

The specimen was washed on the beach near Hilville, Brandon Bay, county of Kerry; but, subsequently, several other fine specimens, with the caudal portion complete, were found on the shores of different parts of the same bay, and at Fahamore, near the Magharees.

The *Lepidopus*, as also the *Trichiurus*, belong to the tœnioids, or riband-fish. The former is remarkable, with an elongated muzzle, mouth cleft, possessing strong trenchant teeth, lower jaw more elongated than the upper. *Lepidopus* of the European seas is a remarkably large and handsome fish, and, being a deep-water species, it is seldom taken on our shores, though I have no doubt its existence would be found not unfrequent. It is a fish possessing a large swimming bladder, is of great swiftness of action, and the scales, though delicate, are of the most silvery brightness: hence its specific name, *argyreus*.

The *Trichiurus*, or hair-tail, has seldom been reported as seen on the British coasts, yet its occurrence I suspect to be by no means rare. Its generic name is significant of its character, hair-tail, from the termina-

tion, instead of a caudal fin, being a long hair-like or compressed filament. The only known one on our shores is the species *Lepturus*, which frequents the Atlantic. It is common on the coasts of Porto Rico, and also on those of Cuba; but it is not so frequent on the American coasts as in the Torrid Zone. One nearly resembling the American species is *T. haumela*, an Asiatic species from the coasts of Malabar.

The three species in the British Museum that have been described by Dr. Gray, in "Zoological Miscellany," are designated *T. armatus*, *T. muticus*, and *T. intermedius*, chiefly distinguished by the forms of the head, operculum, and jaws. They are figured in Griffith's Supplementary Addition to Cuvier's Animal Kingdom. Before the numbers that a few months since were cast ashore on the Cornish coast, and others on the coast of Devonshire, and also the specimen obtained by Dr. Adams, 22nd Regiment, at Kinsale, they had been rarely met, and, indeed, in a scientific point of view, not accurately described; only two, according to Yarrell, having, after gales of wind, been thrown ashore on the British coasts, and those greatly mutilated, insomuch that from their size the true distinctions of the species were not correctly, or with doubt, determined. In the species figured by Yarrell and by Hamilton, in Naturalist's Library, the pectoral fin is shown as pointing downwards; whereas the true position in *T. Lepturus* is pointing upwards, which is the case in all the species, as shown in *T. haumela* and *T. savala*.

The *Trichiuri* are destitute of ventral fins, having near the anal very minute spines, no visible scales. Until those specimens which were found cast ashore during the past winter on the British and Irish coasts, its claims to British ichthyology were very slender. Besides the *Lepidopus*, we have other singular allied fish inhabiting deep water, and but seldom, excepting through gales of wind, seen on our shores—such as the *Gymnetrus* and the red-band fish, *Cepola rubescens*. The latter has, among the larger fuci, been washed ashore on the coast of Waterford. There can be no doubt that *Trichiurus*, and others that haunt deep soundings, are by no means uncommon off our coasts; for it is only when severe gales set in on the coast that those novelties of the deep are noticed. Indeed, I may say that want of scientific knowledge of the several genera and of species have too often been consequent of such occurrences not being made known to us; and were it not from the observations of such men as Doctors Adams and Busteed, the presence of those at Kinsale and at Brandon Bay would never have been revealed.

From what could be gleaned, a more than usual abundance of sprats was cast ashore at Kinsale during the month of December last, and among them, apparently in the action of chase, the *Trichiurus*. Those obtained by Dr. Busteed were about the same time, at distances from each other, stranded in Brandon Bay, county of Kerry, probably engaged in similar pursuits; and I should not be surprised that with the sprats anchovies would have been found.

In *Trichiurus* the dorsal fin commences at the nape of the neck, extending the entire length of the dorsal ridge, the rays being of deeper length near the termination. It is similar in form to *Lepidopus*. It has no ventral or caudal fins, the latter being a compressed filament, with a series of minute spines on the under edge. The stomach is elongated and thick, intestines straight, cœca numerous, and the natatory bladder long and simple. In the form of the jaws, large teeth, operculum, and pectoral fins, it more nearly resembles *T. armatus*, and especially in the position of the lateral line, which commences at the upper edge of the operculum, and, descending with a curve, runs in a line along more than the lower third of the body. In the other species the line is more central, not forming a curve from the operculum, but continuing nearly midway along the body. Five specimens were obtained—four were sent to me. The largest measured, from snout to termination of the caudal filament, 33 inches; the depth of body $3\frac{3}{4}$ inches; the dorsal fin had 135 rays, the pectoral 11 rays; the swimming bladder was long and tubular.

A fine specimen was thrown ashore on the southern side of Tralee Bay, about two miles south-east of Castlegregory. Thus it is remarkable the extent of distance they were cast ashore, no doubt proving the numbers that must exist in deep water off that part of the coast.

In like manner the black fish (*Centrolopus pompilus*) was supposed to be extremely rare, the only known occurrence on the Irish coasts were two specimens recorded as captured in Dingle Harbour. Last summer, during a cruise off that coast, hundreds were seen playing over a piece of floating wreck. The same may be said of the stone-basse, *Polyprion cernium*, of which, under the same circumstances at sea, numbers have been met. I may here mention the occurrence of a beautiful specimen of the *Tunny*, *Thynnus vulgaris*, caught in Brandon Bay, October, 1869. The measurements sent to me by Lord Ventry were—length, four feet three inches; girth, three feet two inches; length of head, one foot one inch; spread of tail, one foot one inch. From the tail forward, on the upper part, it had nine finlets; below, eight finlets. In the several species of bonito, the spurious fins, or finlets, are only eight above.

From the foregoing observations I feel confident that we have not yet gleaned the extent of interest that exists in the marine zoology of our shores, or of the deep water off our coasts. But few local residents have knowledge of such subjects, and, having no means of reference to works of information, many valuable specimens are lost to science; and, though the fishermen are sufficiently intelligent to distinguish objects that are but occasionally met, or that have not before been known to them, yet they are generally found indifferent to the retaining the capture of any fish, or of marine objects, but those that in their estimation are of marketable value.

After some observations from the Chairman and members, the Honorary Secretary stated that parts forming the volume for 1868–69 of the Transactions of the Society, with index, and containing ten

plates, were ready for delivery to members whose subscriptions were not in arrear.

The meeting was then adjourned to the first Wednesday in April.

WEDNESDAY, APRIL 6, 1871.

R. P. WILLIAMS, ESQ., V. P., in the Chair.

The minutes of the previous meeting having been read, confirmed, and signed,

The following paper was read :—

NOTES ON IRISH DIPTERA. BY DR. ARTHUR WYNNE FOOT.

DURING the past year I commenced to add insects of the Dipterous order to my collection, and found the observation of these insects a source of much profit and recreation. I have not been able to do much more than obtain most of the commoner Diptera which usually fall to the lot of a first year's man, but with these ordinary insects I have also taken a few which are not so common. I find that thirty-nine genera and sixty-five species will include my captures. In apology for not having done more in this large order, I am bound to say that my time has been by no means wholly devoted to the two-winged insects, as I took of Hymenoptera thirty-two genera, including sixty-four species, besides many macro and micro Lepidoptera, and a few Neuroptera.

It seems to me that the study of the Diptera offers many attractions for these reasons—their numbers and variety are immense; they are freely and widely distributed; they are among the earliest and latest of our insects in their appearance; they are, in Ireland at least, but imperfectly known; they are easily killed, being very susceptible to chloroform; they are not difficult to set (at least as compared with Hymenoptera); and they relax with facility. Almost all, I may say, that is known of the Irish Diptera is the result of the labours of the late Mr. Haliday. I gladly availed myself of the kind offer of Mr. Verrall, of London, to name the flies I took, and I may be allowed to make a few remarks on some of these. I do not intend to read the list of genera and species.

Eristalis rupium is rare. Caught in all eight species of this genus. There are thirteen given by Walker, in "Diptera Britannica."

Chilosea aestracea, smaller and brighter than English specimens; while English specimens are smaller and brighter than Continental ones.

Syrphus pyrastris, a dipterion generally distributed; Mr. Verrall observed he had hardly ever seen a specimen so dark as mine. I also have dark varieties of *Eristalis intricarius*.

Syrphus grossulariae, rare, and, Mr. Verrall thinks, not hitherto recorded from Ireland. I took it 15th July, 1870, in Woodstock Glen,

Co. Wicklow. Mr. Verrall took it at Rannoch, in Scotland, last year (1870).

Sargus flavipes and *S. bipuncta* are both rather rare; the latter is a local insect. On looking over the Diptera I sent him, Mr. Verrall says he is bound to conclude that Irish Diptera are more brightly coloured than English ones; that he suspected this before, but is now satisfied. It is known that Irish Lepidoptera are usually more darkly coloured than and that in several species melanism is more fully observed in Irish than in English species.

Lucilia sp. regina (?) This was new to Mr. Verrall, and he asked me to get him some if I found the species abundant this year. The species had been very abundant on the inside of the windows of the dissecting room, Medical School, Trinity College, Dublin, in the latter half of the month of May, and I would not have caught them, from a belief that they were the common *L. Cæsar*, but that I wished to get my hand into practice for the coming summer by setting some of them. A *Lucilia*, of which I took a pair near Malahide, has not been yet made out. Mr. Verrall queries it as a variety of *L. Cæsar*.

The *Tabanus bovinus* is the largest of the genus, and is popularly called the gadfly or gad bee; but it is not the true gadfly, nor of the same genus. The gadflies, whether the gad or goad of the horse, ox, sheep, goat, or deer, belong to genus *Æstrus*, and their flight is silent; while that of the tabanus is accompanied by a loud hum. Several of these specimens were caught by standing still, when I heard the loud hum which announced a tabanus to be wheeling round me in gradually narrowing circles, about to light on some part of my coat. The heavy insect is easily taken if allowed to settle. The *Æstrus bovis* lays its eggs in hides of oxen, and I have here a piece of hide of a deer from India, in which the larvæ or caterpillar of a species of *Æstrus* has become established, making what, in the case of *Æstrus bovis*, are known as warbles in cattle of this country. I also have the larval form of the *Æstrus* æqui known as bots, which live in the stomach of the horse.

The *Bombilii*, or bee-flies, are noticeable for the very elegant and fine fur which covers their bodies, for their long probosces with which they sip honey on the wing, and for the shrill singing hum they make in flight. Some of them are abroad early in spring. *B. major* I took early in April, sucking from *Caltha palustris*.

Volucella bombylans has a very strong resemblance to an humble bee, and so have females of *Eristalis intricarius*, and both may be found mixed with various species of *Bombus* at the sallow blossoms in early spring, when the resemblance between them is to many very striking. This *Volucella* (*bombylans*), in its larval state, is parasitic upon the humble bees, so that the fly seems to turn its strong likeness to a very useful account.

The remainder of the flies are of the commoner sort, with which every collector must commence, and I do not think that they will suggest any remarks which would justify my trespassing longer on the time of the Society.

Anthomyia sp. ?
Asilus æstivus.
Aricia lardaria.
Bombylius major.
 " canescens.
Calliphora erythrocephala.
 " vomitoria.
Chilosia œstracea.
Chrysogaster cœmeteriorum.
Chrysomyia formosa.
Chrysotoxum bicinctum.
Conops quadrifasciata.
 " vitellinus.
Cyrtoneura stabulans.
Echinomyia grossa.
Elgiva albiseta.
Empis livida.
 " tessellata.
Eristalis arbustorum.
 " horticola.
 " intricarius.
 " nemorum.
 " pratorum.
 " rupium.
 " sepulchralis.
 " tenax.
Hæmotopota pluvialis.
Helophilus lineatus.
 " trivittatus.
Leptis scolopacea.
Lucilia Cæsar.
 " sp ? Cæsar var ?
 " cornicina.
 " regina ?
Mellanostoma mellina.
Mesembrina meridiana.
Myopa buccata.
 " ferruginea.
Nemotalus uliginosus.
Platycheirus manicatus.
 " peltatus.
 " scutatus.
Pyrellia serena.
Pyrophœna rosarum.
Rhingia campestris.
Sarcophaga carnaria.
Sargus bipunctatus.
 " flavipes.

Scatophaga stercorarea.
Sericomyia borealis.
Syritta pipiens.
Syrphus balteatus.
 ,, *grossulariæ.*
 ,, *pyrastræ.*
 ,, *ribesii.*
 ,, *vitripennis.*
Tabanus bovinus.
Tachina fera
 ,, *viridis.*
 ,, *sp?*
Tetanocera elata.
Thereva sp.?
Volucella bombylaus.
 ,, *pellucens.*
Xylota Sylvarum.

MR. WILLIAM ANDREWS, M. R. I. A., then read a paper entitled :—
 NOTES ON HYMENOPHYLLA, ESPECIALLY WITH REFERENCE TO NEW ZEALAND
 SPECIES.

THE paper that I propose to submit this evening is more with reference to plants that I have principally received from New Zealand, and to those that I have cultivated, than to any extensive notes of a tribe or genera of ferns that present the greatest variety both of novelty and beauty—the *Hymenophyllaceæ*.

Whether we view their distribution in tropical and sub-tropical climes, in the depths of the primeval forests of the Columbian Andes, the dense moist forests of the Amazon, or on the more elevated ranges of the Peruvian mountains, as well as in the tropical ocean islands of the Eastern and Western hemispheres, especially those of volcanic origin, we can rarely meet but among those beautiful tribes, ferns of such extreme delicacy of texture, of minuteness of growth, and others assuming a size equal to their beautiful congeners, *Trichomanes*, than the *Hymenophylla* exhibit.

One of those beautiful localities so frequent in New Zealand, situated in the Wellington district, at some distance from Port Nicholson, having the Rimutaki mountains to the west, and the Manugaraki mountains to the east, lies the lovely valley of Wairarapa. From the heights branching through the deep dells, like silver threads may be seen the Ruamahunga river, while occasionally bursts of foam and mist mark the falls and cascades that interrupt the rapid course of the streams. It is along their shelving banks that the tree-ferns may be seen rearing their lofty heads. *Cyathea medullaris*, the great tree-fern, rising to a height of forty to fifty feet, the korau, or edible mamaku of the natives; *Cyathea dealbata*, the native name ponga or silver fern; these, with

Cyathea Cunninghami, and the *nikau*, or cabbage palm, *Areca sapida*, which grow in the dense forests that bound that valley, all attain a magnificent and lofty height.

From a glowing representation of a friend who visited that valley and kindly sent me seeds and many specimens of living plants, nothing, he expresses, can surpass the extreme beauty and richness of foliage and tint that on all sides surround you. The lofty *totara*,* the *rimu*† and the *mai*,‡ the parasite *rata*, king of the New Zealand trees (*Metrosideros robusta*), and intermingled in interminable masses, are growing with surprising vigour and beauty. *Solanum aviculare*, *Fuchsia excorticata*, many beautiful shrubs of the *Pittosporæ* and of the *Myrtaceæ*, especially *Myrtus bullata*, and *Ralphii*, which seem laced together by the supple-jack (*Rhipogonum scandens*), *kareao* of the natives. There may be met the fragrant flowers of *Veronica speciosa*, the growth always indicating rich alluvial soil; the *Karaka* (*Corynocarpus laevigata*), a noble laurel-leaved tree, and the ti-tree with its nodule of bright green leaves, present such varied features that he could have gazed for hours were he not driven by the incessant and unbearable attacks of myriads of the tipulidæ to retreat to more airy and open grounds.

It is there that the ferns of which the moist and mild climate of New Zealand is so productive abound. Numerous are the genera, but I shall confine myself to the subject of the paper, *Hymenophyllum*, slightly referring to some allied forms. My daughter, who had also visited that valley, corroborates the foregoing description, and mentions the luxuriance with which the ferns grow in the oppressively moist and close atmosphere of the numerous gorges and dells of the valley. *Trichomanes* and *Hymenophyllum* cover the rocks and shaded recesses in vast carpets of deep and of brilliant or lively green, and especially around the huge trunks of the *Rata* and the *Karaka*, from which many beautifully suspended, and hang in graceful masses from those trees, and from the trunks of the tree ferns.

Locality has much effect in the characteristics of those ferns, for in the more shaded recesses are to be met the beautiful fronds of *Leptopteris superba*, the old fronds recumbent and spreading; exhibiting a rich deep green, of velvety appearance, while the young fronds rise erect in the centre like a crest of feathers. *L. pellucida* has a pleasing and delicate appearance—transparent, like *Hymenophyllum*; and glistening with moisture where it grows, affected by the spray of the rushing streamlet near it. The *Leptopteris hymenophylloides*, heru-heru of the natives, covers with luxuriant growth spots not so sheltered, and is of more strong and rigid form, as the specimens which I exhibit plucked in that beautiful valley show. From the examination of *L. pellucida* which

* *Podocarpus tatara*.

† *Dacrydium cupressinum*.

‡ *Podocarpus spicata*.

I have growing these species appear to pass so much into one another that difference of locality may alone have given characteristics of separation. Although differing in appearance and habit of growth, yet each species preserves its membranaceous character, the forked veins of the pinnæ, and the disposition of the sori. Not so with the *Hymenophylla*, for these present the greatest variation of form of frond, pinnules, venation, and involucre, which completely characterise distinct species.

I will now enumerate a few of the species of *Hymenophylla* that I have in cultivation, or in my herbarium. The *Hymenophylla* that I have received from New Zealand, and of which several are growing, are known by the Maories as muka-muk. Those natives are, however, so indolent that no remuneration would induce them to collect, otherwise I should have had a splendid series brought home to me.

Hymenophyllum dilatatum, the largest and most beautiful of the genus, growing on rocks, and pendulously from the trunks of trees.

H. demissum, very abundant.

H. flexuosum, a very pretty fern, with the stipes winged and the margins undulated and crisped.

H. asabrum, pendulous from the trees in the dense forests near Wellington.

H. minimum.—I obtained specimens of this extremely minute fern from Colonel Dwyer, who commanded a division of the 14th Regiment, in New Zealand. It is considered scarce, found growing on the roots of trees. I had some specimens sent me by my friend, Mr. Haines, from Wairarapa Valley, growing on the stem of a tree-fern. It lived for some time in my fernery. On the same portion of the tree-fern a very pretty *Hymenophyllum* is growing. My friend Dr. Alexander, R. N., sent me a specimen of this fern, collected on the sides of a mountain gully, between Chusan and Hong Kong, with *Polypodium lingua*.

H. rarum, another beautiful little species common on the stems of fern-trees, not unlike *H. Tunbridgense*.

H. crispatum, trunks of tree-ferns, New Zealand.

H. Tunbridgense, distributed throughout the island, and in no way differing from British specimens; *Hymenophyllum cupressiforme*; *H. unilaterale*. Of these three forms of ferns from New Zealand the greatest confusion prevails. It has often much surprised me that British botanists are so persistent in making *H. unilaterale* the true representative of *H. Wilsoni*; for I venture to assert that few have ever possessed truly-authenticated specimens of *H. unilaterale*, of Willdenow. and of Bory St. Vincent, and none to have seen living specimens. *H. unilaterale* seems altogether to be confined to the Island of Bourbon, where alone it was met and described by Bory St. Vincent. I hope, should some specimens succeed that I have growing of the New Zealand *Unilaterale* fruit, to be able to enter more fully into the subject. Of the variety *B. cupressiforme* which I exhibit, the fronds are most peculiar, and are such as are described as a variety of *H. Tunbridgense*.

in Hooker's New Zealand Flora; but the involucre is even and entire, similar to *H. Wilsoni*, as the specimen shows. Of *H. unilaterale* of New Zealand, of which the specimen before you has been named and described in New Zealand, the spreading frond more nearly approaches *H. Tunbridgense*; but the fruit, with even and entire involucre, is similar to those of *H. Wilsoni*, with the exception that the lips of the involucre are broader and not ovate.

I have been favoured with a specimen of the true *H. unilaterale* from Reunion, obtained by Dr. Meller, and named by Bory St. Vincent. It unfortunately has no involucre, yet the character of the pinnules of the frond are distinct both from *H. Tunbridgense* and *H. Wilsoni*. I expect a better specimen. In the meantime I will give the account of one who has taken much interest in the study of ferns, especially those of the Mauritius, from which place the communication is sent. I should mention that Reunion is the name given by the French to the Isle of Bourbon in 1793, and resumed again in 1848. The extract, which is very clear and pleasingly written, is from a letter sent to a lady in this city, who is much interested in the subject:—“*Hymenophyllum unilaterale* does not grow in Mauritius, but in the neighbouring island of Bourbon (Reunion), and none has been found there since 1835, so that there was some difficulty in procuring a specimen. This, however, has been managed with the aid of Dr. Meller, the director of the Botanic Gardens here, who was in Reunion when your letter arrived, and who succeeded in getting me an authentic specimen, named by Bory St. Vincent himself, which I now send to you, together with a few of our Mauritius *Hymenophylleæ* and *Trichomanes*, as they may interest you or your friends. Sir Henry (Barkly)* and myself, in concert with Dr. Meller, carefully examined *H. unilaterale*, and we came to the conclusion that it decidedly differs from the description given of *H. Wilsoni* by Hooker in his species *Filicum*, vol. i., page 95, inasmuch as its margin is perfectly smooth, except just at the apex of the segments; while the latter is described as having the margin ‘toothed or spinuloso serrate.’ The air cells, too, which Dr. Meller examined with a microscope, are sufficiently distinct from those of *H. Wilsoni* in Seemann's Journal of Botany, vol. i., page 294. It also appears to differ widely from the description given of *H. Tunbridgense*, to which Sir William Hooker referred a specimen of *H. unilaterale*, sent by Willdenow (*vide species Filicum*). We have not yet found *H. Tunbridgense* in Mauritius, and can only judge from some specimens from Ireland, and from a figure given in ‘Beddome's Ferns of Southern India.’ There can be little doubt, therefore, that *H. Wilsoni* is a distinct species—though whether the same honour can be given to *H. unilaterale*, or whether it is only a peculiar form of some of the Bourbon varieties, remains to be proved. Sir Henry and Dr. Meller both

* Sir Henry Barkly, K. C. B., at that time Governor and Commander-in-Chief at Mauritius, now Governor and Commander-in-Chief at the Cape of Good Hope.

incline, I think, to the latter opinion, as several of the *Hymenophylleæ* from Reunion have a decided tendency to a unilateral character, and I enclose one specimen of *H. Boryanum* found by Dr. Meller growing with a mass of that fern and from the same root, which, you will see, is scarcely distinguishable from *H. unilaterale*. I wish very much I could show you my fernery, which is beginning to be a very good one, and we have also a fine collection of orchids from Madagascar, some of which are quite new and very beautiful."

In corroboration of such a statement so decided and valuable, I some years since, being much interested with regard to the doubts that existed of the distinctive characters of those two species—*Wilsoni* and *Unilaterale*—had the opportunity of communicating direct with Bory St. Vincent at Paris, a short time before his death. His reply—"There absolutely remains to me but one specimen. Wildenow, Ventanal, and the old Jacquine of the neighbourhood (Bourbon), who were then my correspondents of those countries, have not yet found it, no more than three or four other rare species which I have equally exhausted, and which possess but the type of my herbal."

Trichomanes longisetum I discovered in the thick forests of the Island of Bourbon.

Wildenow's description of *H. unilaterale* is from the communication made to him by Bory St. Vincent:—"Habitat in insulæ Borboniæ montibus mille orgyis supra mare elevatis, ad rupes humidas."—Bory in Litt.

The above-quoted letter states that attention has been given by Dr. Meller to the character of air cells; and in the examination of those of *H. unilaterale* he finds them to be sufficiently distinct from those of *H. Wilsoni*, as figured in Seeman's Journal. George Gulliver, F.R.S., Professor of Anatomy and Physiology in the Royal College of Surgeons, in his Paper on the "Leaf Cells of the British *Hymenophylliæ*," observes a great distinction between those of *H. Tunbridgense* and *H. Wilsoni*, the former being round, or nearly so, and the latter oval, with an average long diameter, and he forms the diagnostics of the two species by terms "sphærenchyma and ovenchyma." Mr. F. Clowes, of Windermere, who has made several communications to me on the subject, states that the fronds of *H. Tunbridgense* die annually, while those of *H. Wilsoni* grow on from year to year. This I can confirm by observations on their growth in my own fernery. In the extract I have given it is further stated that *H. Boryanum* is scarcely distinguishable from *H. unilaterale*. The venation of this little fern is similar to that of *Tunbridgense*, but differs in the hairy underneath part of the frond, and with the branched hairs at the margins.* These involucre are orbicular, ciliated, and sunk in the frond.

I have had much correspondence with my friend Mr. Wilson regarding the interest of the species that he has described, and from my

* These branched hairs, or forked ciliæ, are frequent on those ferns of the tropics.

extensive examinations of those ferns in all seasons and localities in this country, I am more than ever confirmed in the truly distinctive characters of *H. Wilsoni*, and that no British nor foreign botanists had ever before described it. This leads me to observe on the subject of discovery. Dr. Graves, it would appear, first found and noticed *H. Wilsoni*, but did not even guess that there were two species of that fern existing in Britain. Therefore to Mr. Wilson, who distinguished and described the plant, is eminently and justly due the discovery. It might just as well be said that any collecting botanist who sent to Dr. Moore, Director of the Royal Dublin Society's Botanic Gardens, and on whom the cryptogamic mantle of the late Dr. Taylor, of Kenmare, has fallen, a mass of lichens or of mosses unnamed, and among which Dr. Moore found and described new species, that the collector was the discoverer, not the describer; I should certainly say that Dr. Moore would be the discoverer.

The cultivation of *Hymenophyllum* and *Trichomanes* seems to be but little understood even by our most eminent nurserymen; I mean to exhibit them growing naturally, as in the recesses of their native glens. I have seen those cultivated at Veitch's magnificent nursery at Chelsea, and they certainly exhibited healthy characters of growth, but they were crowded and cramped under huge bell glasses, through which the outlines of the fronds were but dimly seen, and only a momentary glance was permitted on the removal of the glass. I saw there beautiful plants of that splendid fern, *Trichomanes anceps*, from Brazil, similarly growing. In my own fernery, which is built in a shaded recess, those beautiful ferns have ample field of growth, rambling over, with their spreading and creeping rhizoma, the portions of rock and blocks of trees arranged for their protection.

Major-General Warre, C. B., a distinguished officer, who commanded the 57th Regiment in Taranaki, New Zealand, and now in command of the Infantry Brigade at the Curragh, observed that it was like peeping into one of the recesses of the rocky and wooded glens of that country. Captain Clarke, his aide-de-camp, a good practical botanist, well understands the ferns of New Zealand, and has made a good collection.

Few seem to attend to the best plans for the collecting and transmission home of the plants of that beautiful tribe. The Wardian cases are not so well suited, and moisture will blacken the fronds, and in most cases totally destroy the vitality of the rhizoma. When on the eve of leaving the country, boxes should be provided of suitable size, which may be lined with zinc or tin. Collect masses of *Hymenophyllum* in the fresh state, but with no moisture on them; put a layer at the bottom of the box; then spread either *Trichomanes* or *Hymenophyllum*, or other ferns that may be collected in the same state of freshness, but not damp, and over them another layer of *Hymenophyllum*, or mass of mosses or *Lycopodiums*; and thus pack tightly till the box is filled, which may be secured air-tight, and placed in the coolest part of the ship's hold. The plants will thus keep fresh for many months.

In concluding, I cannot too highly praise those gentlemen whose

tastes and means lead them to introduce to cultivation such a beautiful tribe of plants. What can be more beautiful than the ferneries of Mr. Bewley, of Rockville, Blackrock, and of Dr. Hudson, of Lowville, Merrion? They are of the greatest interest, not only for the extreme beauty of the arrangement of the houses, but for the rarity and novelty of many of the ferns introduced to cultivation, which few would otherwise have the opportunity of knowing and of examining. Those gentlemen always kindly permit those interested to see them, and much information can be gleaned from their intelligent gardeners.

During the reading of the paper some beautiful drawings taken on the spot in New Zealand were shown. The Rata, Karaka, Tree-ferns, &c., were conspicuous. There were also exhibited to the members a beautiful series of *Hymenophylla* and *Leptopteris*.

WEDNESDAY, JUNE 7, 1871.

E. PERCEVAL WRIGHT, M. D., V. P., in the Chair.

The Minutes of the previous Meeting having been read, compared, and signed, the following donations to the Library were laid before the Meeting:—Parts I, II., and III. for the year 1870 of the "Proceedings" of the Scientific Meetings of the Zoological Society of London, "Canadian Journal of Science for May," "Journal of the Royal Historical and Archæological Association of Ireland," vol. i., Fourth Series; "Journal of the Linnean Society," vol. xi., No. 56; "Atti della Societa Italiana di Scienze Naturali Milano," Parts 1 and 2, vol. xiii.; "Proceedings Natural History," Hermannstadt.

The thanks of the Society having been voted,

DR. A. W. FOOT made the following communication and exhibition of

SOME NATIVE HYMENOPTERA.

THE few Hymenoptera which I had an opportunity of collecting in a short holiday in the country last summer are laid before the meeting. The collection includes thirty-one genera and sixty-three species.

This great order of insects is divided into two sections by the character of the ovipositor. In one section—Terebrantia—it takes the shape of a saw, auger, or other boring instrument; and to this section belong the Sawflies, Woodborers, Gallflies, and Ichneumons. In the other section—Aculeata (from *aculeus*, a sting or prickle)—the ovipositor has a needle-like character, and in the females and neuters, being connected with a reservoir of poison, can be used as a weapon of defence. This section comprises the Ants, Sandwasps, Wasps, and Bees.

The Terebrant Hymenoptera are divided into two sub-sections—the Phytophaga (plant-eaters), comprising the Sawflies and Woodborers; and the Entomophaga (insect-eaters), including the Ichneu-

mons, the gall-making insects, and the Chrysididæ (ruby-tails). Among the Terebrant Hymenoptera exhibited there is a variety of the female of *Tenthredo ambigua*, taken at rest on the blossom of a Scotch thistle; several very fresh specimens of *Tenthredo viridis*, of both sexes, found running over the leaves of young and rank plants of *Urtica dioica*; and a female of *Dolerus coracinus* found kicking on its back in the sand near Malahide.

The tibiæ of the fore-legs of the Sawflies have two spurs, by which character either sex of the Sawflies can be distinguished from the Woodborers without the trouble of dissection.

There are a few of the Entomophagous sub-section of the Terebrant Hymenoptera in the boxes in the specimens of the Gn. Chrysis, known as ruby-tails or fireflies. These insects, when taken hold of, make an aggressive use of their ovipositor, which, though it cannot be considered as a sting, more than the prickle of a furze bush can, because there is no poison bag attached, may yet pierce and hurt the soft skins of children: hence these beautiful insects are generally treated with great respect when found on the panes of the windows in a nursery in the hottest days of July. These insects are parasitic, depositing their eggs in the cells of sandwasps and wild bees. When attacked they roll themselves up by turning the abdomen underneath the thorax in an extreme degree of emprosthotonos, and, being sting-proof, the only way the owner of the invaded nest can injure them is by cutting off their wings, which mutilation, however, does not prevent them from accomplishing their object of depositing their eggs in a ready-made nest.

The Ichneumonidæ form a very large family of the Terebrant Hymenoptera, containing about 120 genera, and more than 1100 species. There are in this box only eight genera and twenty-three species. Ichneumons are easily recognised by their pinched waists. The long and slender abdomen is set on to the body of the insect by a small point, or by a fine stalk at the extreme end of the thorax, between the hind legs. The ovipositor, which is a needle-like organ, consisting of a horny sheath, guarded by a pair of valves, and enclosing two slender serrated bristles, is in some specimens short, and concealed within the abdomen; in others visible, and occasionally of great length, considerably exceeding that of the body. The Ichneumons and the Gallflies are comprised in a division of Terebrant Hymenoptera called Spiculifera, or dart-bearers, from the elongated character of the ovipositor. The use of the Ichneumon family in nature appears to be to check the destruction of vegetation by the larvæ of other insects.

Of the large cuckoo bees there are two males and two females of *Apathus rupestris*, parasitic on *Bombus lapidarius*, and a female of *Apathus campestris*, parasitic on *Bombus subterraneus*. The resemblance between these parasitic bees and their hosts is very close, and there appears to be great harmony between the idle and the working bees. There are but two sexes in *Apathus*.

Of *Bombus* there are here six species. Eighteen are given in Mr. Smith's Catalogue of British Hymenoptera. The derivation of the

term humble-bee appears to be from a corruption of the word humming bee, which appropriately describes the sonorous flight of these large bees.

There are some specimens here of the solitary bees, as distinguished from the social and parasitic bees, amongst which are two species of *Sphæcodes*, one of the family of short-tongued bees, small black and red shining insects; three species of the genus *Halictus*; and three of the genus *Andrena*. Next in order are seen three species of the wasp-like parasitic or cuckoo-bee *Nomada*, another species of the five genera of cuckoo-bees; then two specimens of one of the leaf-cutter bees, *Megachile centuncularis*. This species is considered to be the most widely distributed bee in the whole family of *Apidæ*. Then come some specimens of the sand-burrowing and wood-boring wasps, distinguished from the true wasps by their fore wings, which are not folded; *Crabro cephalotes*, which burrows in decaying wood, and provisions its nest with *Diptera*; *Pemphredon lugubris*, another fossorial wood wasp; *Mellinus arvensis*, one of the most common of the sand wasps; and *Pompilus exaltatus*, another equally abundant species of sand wasp. Of the social wasps there are in the box four of the seven Irish species—*Norvegica* and *Sylvestris* (tree wasps), *Vulgaris* and *Rufa* (ground wasps). One of the two genera of solitary wasps is represented by *Odynerus trimarginatus*. Two queens and four workers of the Alpine, Ligurian, or bright-banded honey bee are placed beside a queen and some workers of the common brown honey bee, for comparison.

The number of species collected by me is very small; but the time at my disposal was by no means exclusively devoted to Hymenoptera, or probably this most extensive order of insects would have been more fully represented here this evening.

LIST OF HYMENOPTERA COLLECTED.

Terebrantia.

- Cimbex femorata.*
- Trichosoma lucorum.*
- Lophyrus pini.*
- Athalia rosæ.*
- Allantus arcuatus.*
- Tenthredo ambigua.*
- „ *viridis.*
- Dolerus coracinus.*
- Chrysis ignita.*
- Ichneumon flavoniger.*
- „ *palliatorius.*
- „ *fasciatorius.*
- „ *terminatorius.*
- „ *extensorius.*
- „ *umbraculosus.*

Ichneumon hæmorrhoidalis.

„ *sarcitorius.*

„ *nigricornis.*

„ *fumigator.*

„ *hilaris.*

„ *proteus.*

„ *fusorius.*

„ *torvus.*

Glypta resinanæ.

Pimpla instigator.

Exetastes lævigator.

„ *fornicator.*

Paniscus inquinatus.

Ophion luteus.

Anomalon xanthopus.

„ *ruficorne.*

Lampronota sulphurifera.

Aculeata.

Apathus rupestris.

„ *campestris.*

Bombus senilis.

„ *lapidarius.*

„ *lucorum.*

„ *terrestris.*

„ *subterraneus.*

„ *muscorum.*

Sphecodes gibbus.

„ *ephippiæ.*

Halictus rufescens.

„ *rubicundus.*

„ *abdominalis.*

Andræna albicrus.

„ *trimmerana.*

„ *nigroænea.*

Nomada ochrostoma.

„ *succincta.*

„ *alternata.*

Cœlioxyx simplex.

Megachile centuncularis.

Crabro cephalotes.

Pemphredon lugubris.

Mellinus arvensis.

Pompilius exaltatus.

Vespa norvegica.

„ *sylvestris.*

„ *vulgaris.*

„ *rufa.*

Odynerus trimarginatus.

Apis mellifica.

„ (var. *Liguria*).

„ *mellifica.*

„ (var. *domestica*).

MR. WM. ANDREWS then made the following communication :—

ON SOME IRISH SAXIFRAGES.

OF the Robertsonian saxifrages which constitute the *geum* and *umbrosa* forms, the most remarkable varieties occur, and which had been separated by British botanists into *geum*, *elegans*, *dentata*, *hirsuta*, *umbrosa*, *punctata*, and *serrata*. These, however, all resolve into two species—*umbrosa* and *geum*. The forms of the leaves of the varieties are extremely beautiful. Some are of large size, much elongated and deeply serrated, coriaceous, and of a dark green; others almost orbicular, with fine serrations, and again deeply serrated.

It has been stated that those of the Pyrenees are peculiarly distinct, and that the forms found in Ireland are by no means identical or possessing the same characteristics—that the truly blunt crenate variety does not exist in Ireland. I should say that all the forms of the Robertsonia saxifrages found in Ireland, in the south-west parts, at certain elevations, are identical with those of similar ranges of elevation in the Pyrenees, and that the species which I now submit are similar in form with those found on the Western Pyrenees and on the mountain ranges of Portugal.

The singular fact of the peculiarly distinct varieties of form of the saxifrages may arise from their proximity to each other. In testing experiments with the seeds of *umbrosa*, I have found that the greater number of the seedling plants assumed the *geum* form. All the varieties retained their character permanently when cultivated from offsets.

In the second edition of the British Flora, by Sir William Hooker, the subject of the saxifrages, although fully given, is cautiously dilated on, especially with reference to the hypnoid family; and the observations of subsequent years have verified the views that were certainly then formed—that the opinion of botanists were very variable as to what is and what is not a species. The common form of *Saxifraga umbrosa* of the western parts of Ireland varies from the true *umbrosa* of the Pyrenees, the former having the leaves obovate, with sharp cartilaginous notches, the latter with the leaves obovate, retuse, and cartilaginously crenated (Lapeyrouse, Figures de la Flore des Pyrénées, Tab. 22).* All the forms of *geum* found in Ireland are identical with those of the western parts of Spain and Portugal.

* The provincial name of *umbrosa* has been erroneously given in botanical works, terming it St. Patrick's Cabbage, the true appellation being *Cabaiste maidhre*, Fox's Cabbage, *madadh ruadh* meaning the Red dog.

Among the forms which I now exhibit is a very fine species of *geum*, found in the Great Blasket Island, coast of Kerry, at the extreme western point of that island, exposed to the western gales and sprays of the Atlantic. The drawing of the plant was taken of a specimen in full flower by my lamented friend, the late George V. Du Noyer, whose talents as a practical geologist, and as an artist of celebrity in portraying most accurately and vividly all objects of natural history, have made his loss to us great. This beautiful saxifrage is remarkable in having a series of glands of a rich rose colour, surrounding the base of the ovary, which give a remarkable appearance to its inflorescence. It seems a singular approach to *Parnassiæ* and *Crassulaciæ*, and still more so by the seedlings maintaining the character of the original plant, producing the metamorphic glands of the parent. Mr. A. G. More has noticed at the entrance of Dingle harbour the remarkably large and strong growth of forms of *geum* exposed to the sprays of the sea.

Another form I wish to submit, in order that botanists in their excursions in this country may recognise it by its form of leaves. It has already been described by the late Dr. Harvey, and although so remarkable from other forms of *umbrosa* in the foliage, yet in that variable family no specific separation would be formed on such characters. It is in the floral organs that the distinction is maintainable, and which are so remarkable that it would puzzle botanists to assert with certainty what hybridisation could have produced such characteristics of the ovary, which cause its affinity to plants whose periods of flowering and perfecting their seeds are at an early and late periods of the season. This, as Mr. C. Watson expresses, in his last edition of the "*Cybele Britannica*," is a botanical puzzle, and one that renders it very difficult to withdraw from its botanical distinction.

I may refer to some remarkable specimens of *Saxifraga stellaris* obtained on moist rocks in one of those wild mountain retreats near Loc Coomeathcun, county of Kerry. It appears very distinct from the more hirsute and more compact forms met on the Connor Cliffs, opposite the Brandon range. The flowering stems are of far more elongated growth, and, what is remarkable, many produce in the axils of the bracts foliaceous buds.

These characteristics ally it with *S. leucanthemifolia* of the Pyrenees, and decidedly to *S. foliolosa* of Robert Brown, described in Torrey and Gray's American Flora. On referring to notices already given of these forms of saxifrages, I was not surprised to find, in the eleventh volume of the "*Annals of Natural History*," an article by John Ball, Esq., a well-known European botanist, that he had gathered in the Otzal in the Tyrol the plant described as *S. leucanthemifolia* (Lap) by Reichenbach and other German botanists, and he was quite of the opinion of Bertoline that it is only a state of *S. stellaris*. Mr. Ball gives its characteristics, showing how nearly or identical it is with some of the forms of *S. stellaris*. He mentions a variety of *S. stellaris* found by him in Curslieve, in Mayo, which is much more different from the ordinary form. It is larger, hairy, and somewhat viscose, the panicle

widely spreading, the bracts foliaceous. He considers this to be the same as *S. clusii*, variety A. of De Candolle's prodromus. Similar forms have been found by me in Kerry. The late Professor Kinahan mentioned to me that he had noticed in Mayo the singular form *S. Andrewsii*.

These notes are merely intended as reference to the plants exhibited, not to any definite descriptions of their botanical characteristics.

After some observations of the Chairman, who remarked that in looking over the collections of native saxifrages of the late Dr. Harvey, Professor of Botany to the University, he had observed how variable were the forms of that order of plants, many presenting singular characteristics, yet having no decided specific distinctions, the private business of the society was then discussed.

Notice had been given at the general meeting held on the 5th of April last, "That it would be submitted to the members the necessity of the removal of the museum collections of the society from Mr. Williams's rooms, Dame-street, and to adopt means for their further disposal."

The following resolutions were proposed and seconded:—

"That the following gentlemen be nominated to form a committee for the purpose of reporting the best means for the disposal of the museum collections—viz., Professor Haughton, F.R.S.; R. P. Williams, Esq.; Dr. A. W. Foot, Robert J. Montgomery, Esq.; and Arthur Andrews, Esq."

"That Mr. Montgomery be appointed to act as secretary to the committee."

"That the library of the society be deposited in charge of the treasurer, Mr. Arthur Andrews."

Passed unanimously.

The warm thanks of the society were unanimously given to the president and members of the council of the Royal Irish Academy, for granting such comfortable arrangements for the meetings of the members.

The session being terminated, the society was adjourned to the first Wednesday in November.

NATURAL HISTORY SOCIETY OF DUBLIN IN ACCOUNT WITH THE TREASURER.

1870. May 4, June 2, Sept. 7, Oct. 31,	Dr.	1869.		Cr.	1870.	
		£	s. d.		£	s. d.
	To Engraving Plates, ...	8	8 0	By Balance brought forward, ...	56	9 9
	— Attendance at Meetings, ...	3	4 0	— Subscriptions, ...	36	5 0
	— Assistant-Secretary, half year, ...	5	0 0	— One Year's Dividend on £233 4s. 10d. in		
	— Secretary's Account, Postage, &c., ...	4	6 11	— New Three per Cent. Stock, ...	6	17 11
	— Collector's Commission, ...	2	12 6			
	— Newspapers and Postage, ...	0	13 0			
	— Balance, ...	75	8 3			
		£99 12 8				
		1870. Nov. 2.		Balance, ...	£75	8 3

ARTHUR ANDREWS, *Treasurer*

Nov. 2, 1870.

We have examined the above Account, and compared same with the Vouchers. We find it correct; and that there is a Balance of £75 8s. 3d. to the credit of the Society; and that there is £233 4s. 10d. New Three per Cent. Stock.

R. P. WILLIAMS,
ROBERT ROBERTS, } *Auditors.*

No. I.

LIST OF MEMBERS.

Corrections of Errors or Omissions will be thankfully received by the Secretaries.

HONORARY MEMBERS.

Elected.

- 1863. 1. Agassiz, D. L., F. R. S., F. L. S., *Cambridge, U. S.*
- 1858. 2. Bate, Charles Spence, F. R. S., F. L. S., 8, *Mulgrave-place, Plymouth.*
- 1854. 3. Bell, Thomas, F. R. S., F. L. S., F. G. S., *Selborne, Hants.*
- 1845. 4. Berkeley, Rev. Miles Joseph, M. A., F. L. S., *King's Cliff, Wandesford.*
- 1863. 5. Carus, J. Victor, M. D., &c., *Leipzig.*
- 1860. 6. de Brébisson, Alphonse, *Falaise, France.*
- 1853. 7. Gray, John Edward, Ph. D., F. R. S., F. L. S., F. G. S., *British Museum.*
- 1863. 8. Gray, Asa, M. D., *Cambridge, U. S.*
- 1846. 9. Hincks, Rev. Dr., *Belfast.*
- 1863. 10. Huxley, T., M. D., F. R. S., F. L. S., F. G. S., &c, 26, *Abbey-place, St. John's Wood*; and 28, *Jermyn-street, London.*
- 1863. 11. Hyrtl, Joseph, M. D., Professor of Anatomy, *University of Vienna.*
- 1841. 12. Jones, Thomas Rymer, F. R. S., 18, *St. Leonard's-terrace, Bloomfield-road, London.*
- 1863. 13. Leidy, Joseph, M. D., *Philadelphia.*
- 1863. 14. M'Coy, Frederick, F. G. S., *University of Melbourne.*
- 1851. 15. Munroe, Colonel W., F. L. S., *39th Regiment.*
- 1854. 16. Newman, Edward, F. L. S., 9, *Devonshire-street, Bishopsgate, London.*
- 1863. 17. Owen, Richard, D. C. L., LL. D., F. R. S., F. L. S., F. G. S., &c., *British Museum, London.*
- 1859. 18. Patterson, Robert, F. R. S., M. R. I. A., *Belfast.*
- 1841. 19. Boyle, Forbes, *King's College, London.*
- 1854. 20. Sabine, Major-General Edward, R. A., D. C. L., LL. D., F. R. S., F. L. S., 13, *Ashley-place, Victoria-street, Westminster.*
- 1854. 21. Westwood, Joseph Obadiah, A. M., F. L. S.

LIFE MEMBERS.

- 1838. 1. Andrews, William, M. R. I. A., F. R. G. S. I., 4, *Nassau-street*; and "*The Hill*," *Monkstown.*
- 1857. 2. Archer, William, *St. Brendans, Grosvenor-road, West.*
- 1863. 3. Ball, Robert, 47, *Wellington-place.*
- 1857. 4. Barnewall, Richard.
- 1849. 5. Borough, Sir Edward, Bart., 4, *Nassau-street*; 61, *Fitzwilliam-square, N. and Glenavena, Howth.*
- 1860. 6. Corbett, J. H., Professor of Anatomy, *Queen's College, Cork.*
- 1858. 7. Crowe, Edward, *Brighton-terrace, Bray.*
- 1855. 8. Haughton, Rev. Samuel, M. D., F. T. C. D., F. R. S., M. R. I. A., V. P. R. G. S. I., 51, *Wellington-road.*
- 1845. 9. Hemphill, Robert, 3, *Great Clarence-street.*
- 1838. 10. Hill, Lord George, M. R. I. A., *Gweedore, Dunfanaghy.*
- 1848. 11. Hone, Nathaniel, M. R. I. A., *St. Doulough's.*
- 1854. 12. Maxwell, Robert Perceval, *Groomsport, Bangor, Co. Down.*
- 1848. 13. Montgomery, Robert John, 50, *Grosvenor-square, Rathmines.*
- 1863. 14. M'Clintock, Sir Leopold, R. N., LL. D.
- 1840. 15. Pollock, George A., *Oatlands, Navan.*
- 1863. 16. Powerscourt, Viscount, *Powerscourt, Enniskerry.*

Elected.

1840. 17. Raye, Henry R., *Greencastle, Buncrana*.
 1847. 18. Renny, Henry Lawes, R. E., M. R. I. A.
 1850. 19. Smith, George, 71, *Lower Baggot-street*.
 1863. 20. Smyly, Ph. C., M. D., F. R. C. S. I., 4, *Merrion-square, North*.
 1839. 21. Townsend, R. W.
 1856. 22. Whitty, John Irvine, LL. D., D. C. L., 94, *Lower Baggot-street*.
 1838. 23. Williams, Richard Palmer, M. R. I. A., F. R. G. S. I., 38, *Dame-street*.

ANNUAL MEMBERS.

1863. 1. Andrews, Arthur, 4, *New Brighton, Monkstown*.
 1867. 2. Andrews, George, *Williamstown Castle*.
 1863. 3. Andrews, Henry, *Hastings, Ovoca-avenue, Blackrock*.
 1861. 4. Armstrong, Andrew, *Claddagh-terrace, Bray*.
 1863. 5. Barker, John, M. D., F. R. C. S. I., M. R. I. A., F. R. G. S. I., 83, *Waterloo-road*.
 1843. 6. Barrington, Sir John, *Glenvar, Merrion-avenue, Blackrock*.
 1867. 7. Barrington, R. M., *Fassaroe, Bray*.
 1854. 8. Barton, Henry Malkin, 5, *Foster-place*.
 1863. 9. Bennett, E. H., M. D., F. R. C. S. I., F. R. G. S. I., 26, *Lower Fitzwilliam-street*.
 1860. 10. Bewley, Thomas, *Rockville, Newtownpark-avenue, Blackrock*.
 1863. 11. Bradshaw, G. B., F. R. G. S. I.
 1851. 12. Brady, Francis William, Q. C., 22, *Upper Leeson-street*.
 1863. 13. Brady, Thomas F., *Percy-place*.
 1865. 14. Brooke, Sir Victor A., Bart., *Colebrook, Brookeborough*.
 1863. 15. Brownrigg, William Bookey, A. B., Ex. Sci. Sch., T. C. D., F. R. G. S. I., *Moorhill, Brannoxtown*.
 1865. 16. Byron, Ryland, 2, *Fitzwilliam-place*.
 1864. 17. Cane, Richard, 60, *Dawson-street*.
 1864. 18. Carte, Alexander, M. D., F. R. C. S. I., F. L. S., M. R. I. A., F. R. G. S. I., *Royal Dublin Society, Kildare-street*.
 1863. 19. Carte, William, L. R. C. S. I., *Royal Hospital, Kilmahnam*.
 1864. 20. Clermont, Right Hon. Thomas, Baron, M. R. I. A., *Ravensdale Park, Newry*.
 1867. 21. Cruise, Francis R., M. D., 3, *Merrion-square, East*.
 1860. 22. Dawson, George, *Peacock Lodge, Balbriggan*.
 1865. 23. Dickson, Rev. Benjamin, D. D., F. T. C. D., M. R. I. A., 1, *Kildare-place*.
 1854. 24. Domville, William Compton, J. P., D. L., *Thornhill, Bray*.
 1856. 25. Doyle, John B., F. R. G. S. I., *Ballycastle, Co. Antrim*.
 1863. 26. Edgeworth, R. L., M. B., *Kildare-street Club*.
 1856. 27. Frazer, William, L. K. Q. C. P., L. R. C. S. I., 20, *Harcourt-street*.
 1862. 28. Foot, Arthur Wynne, M. D., 21, *Lower Pembroke-street*.
 1865. 29. Garnett, William Stawell, *Williamstown, Kells*.
 1866. 30. Grainger, Rev. John, *University Club*.
 1844. 31. Griffith, Sir Richard, Bart., LL. D., M. R. I. A., F. G. S., F. R. G. S. I., 2, *Fitzwilliam-place, South*.
 1854. 32. Houghton, James, *Chelsea Lodge, Duncannon, Co. Wexford*.
 1856. 33. Hodges, William, *Bank of Ireland*.
 1867. 34. Hodgson, E. M., *St. Kevin's, Rathmines*.
 1863. 35. Hudson, Alfred, M. D., 2, *Merrion-square, North*.
 1864. 36. Jacob, A. H., M. D., F. R. C. S. I., 23, *Ely-place*.
 1861. 37. Johnston, Maziere, 7, *Synnott-place*.
 1855. 38. Kift, Thomas, *Proby Park, Dalkey*.
 1862. 39. Kinahan, Edward H., 11, *Merrion-square, North*.
 1868. 40. Knox, Major L. E., 53, *Fitzwilliam-square*.
 1858. 41. Lalor, John Joseph, 2, *Longford-terrace, Salthill*.

Elected.

1863. 42. Law, Robert, M. D., Hon. F. K. Q. C. P., M. R. I. A., 25, *Upper Merrion-street*.
1863. 43. Lee, Rev. William, D. D., Archdeacon of Dublin, 24, *Merrion-sq., South*.
1859. 44. Mathews, Edward, 62, *Middle Abbey-street*.
1859. 45. Maziere, William, 1, *Gardiner's-place*.
1867. 46. Minchin, Humphry, M. D., 56, *Lower Dominick-street*.
1862. 47. Montgomery, Thomas Alexander, *Howth*.
1862. 48. Montgomery, Alexander John, *Howth*.
1863. 49. Moore, David, Ph. D., F. L. S., M. R. I. A., Director *Royal Dublin Society's Botanic Garden, Glasnevin*.
1864. 50. Moore, Robert H., F. R. C. S. I., 28, *Upper Merrion-street*.
1868. 51. Moore, W. Montgomery, *Howth*.
1863. 52. Morgan, John, M. D., F. R. C. S. I., 23, *Stephen's-green, North*.
1863. 53. Macalister, Alexander, L. K. Q. C. P., L. R. C. S. I., Professor of Zoology, *Trinity College*.
1863. 54. M'Donnell, Robert, M. D., F. R. C. S. I., F. R. S., M. R. I. A., 14, *Lower Pembroke-street*.
1859. 55. M'Dowel, Benjamin G., M. D., C. M., F. R. C. S. I., Professor of Anatomy, *Trinity College*.
1853. 56. M'Dougall, William, M. R. I. A., *Drumlish House, Carrickbrack, Howth*.
1863. 57. Napier, Right Hon. Sir Joseph, Bart., M. R. I. A., 4, *Merrion-square, South*.
1863. 58. Nolan, Edward, 1, *Palmerston Villas, Upper Rathmines*.
1840. 59. Nugent, Daniel, 7, *Denmark-street*.
1860. 60. O'Brien, Octavius, F. R. G. S. I., 23, *Kildare-street*.
1848. 61. O'Mahony, Rev. Thaddeus, *Trinity College*.
1859. 62. Peacock, Peter Leslie, *Merrion-square*.
1866. 63. Perrin, Richard, 97, *Upper Mount-street*.
1858. 64. Porte, George, M. R. I. A., F. R. G. S. I., *Lansdowne Lodge, Beggarsbush-road*.
1858. 65. Reeves, Robert, 22, *Merrion-square*.
1867. 66. de Ricci, Herman R., M. D., *Upper Merrion-street*.
1856. 67. Roberts, Robert, *Bank of Ireland*.
1855. 68. Smith, Robert William, M. D., F. R. C. S. I., M. R. I. A., F. R. G. S. I., 63, *Eccles-street*.
1866. 69. Smith, Walter, M. B., 121, *Lower Baggot-street*.
1856. 70. Stephens, Henry Colclough, 8, *Pembroke-place*; and *Greenwood, Shankill*.
1863. 71. Stokes, William, Jun., M. D., C. M., L. R. C. S. I., 3, *Clare-street*.
1856. 72. Sutherland, Alexander, 60, *Upper Sackville-street*.
1840. 73. Todhunter, Joseph, 3, *College-green*.
1868. 74. Traquair, Professor R. H., M. D., *Royal College of Science, Stephen's-green*.
1866. 75. Tyner, G. St. G., M. D., *Asylum, Downpatrick*.
1865. 76. Ventry, Lord.
1864. 77. Waller, George A., 5, *Brighton Vale, Monkstown*.
1855. 78. West, Very Rev. John, D. D., M. R. I. A., Dean of St. Patrick's, 6, *Wilton-place*.
1863. 79. Whiteside, Right Hon. J., Chief Justice Queen's Bench, 2, *Mountjoy-square*.
1866. 80. Williams, William, *Bachelor's-walk*.
1866. 81. Wilson, G. Orr, A. M., *Dunardagh, Blackrock*.
1862. 82. Wilson, Thomas, 79, *Waterloo-road*.
1865. 83. Woodworth, Joseph H., 37, *Dame-street*.
1854. 84. Wright, E. Perceval, M. D., F. R. C. S. I., F. L. & Z. S., M. R. I. A., Professor of Zoology Dublin University, 5, *Trinity College*.

ASSOCIATE MEMBERS.

Elected.

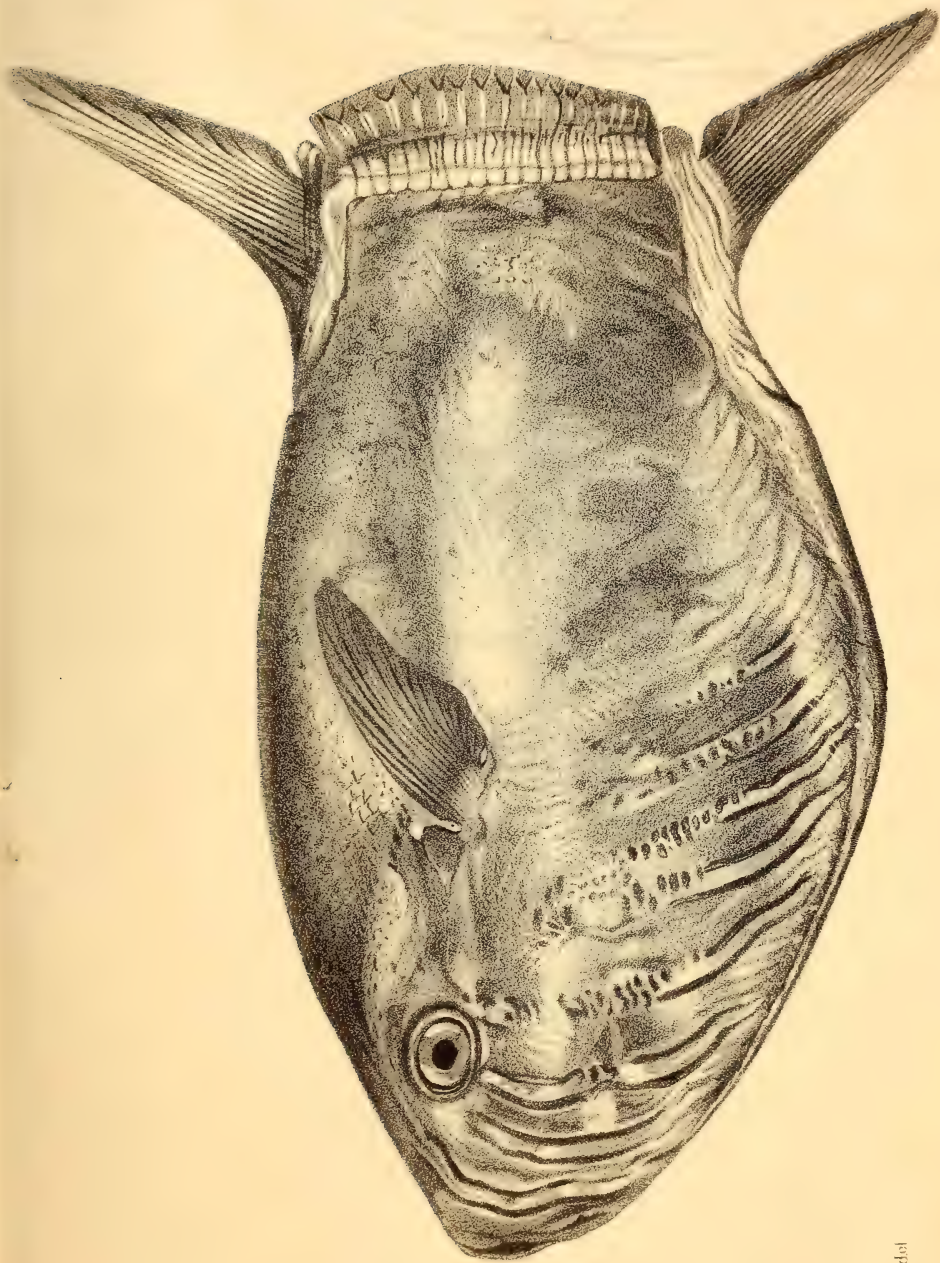
1865. 1. Gloyne, C., 5, *Haddington-terrace*.
 1869. 2. Glennon, John, *Wicklow-street*.

CORRESPONDING MEMBERS.

1865. 1. Alexander, Surgeon, R. N., *Queenstown*.
 1863. 2. Allman, George J., M. D., F. R. C. S. I., F. R. S., M. R. I. A., Regius Professor of Natural History, *University of Edinburgh*.
 1863. 3. Allman, R. L., *Bandon, Co. Cork*.
 1863. 4. Babington, Charles Cardale, M. A., F. R. S., F. L. S., F. G. S., Professor of Botany, *St. John's College, Cambridge*.
 1861. 5. Blackett, Edward R., M. D., *Southwold, Wangford, Sussex*.
 1863. 6. Bowerbank, J. Scott, LL. D., F. R. S., F. L. S., F. G. S., *St. Leonard's*.
 1865. 7. Brady, G. F., F. R. C. S. E., *Strabane*.
 1868. 8. Brocas, F. Y., 4, *Mill-street, Hanover-square, London*.
 1863. 9. Browne, Captain Thomas, F. L. S., *Manchester*.
 1863. 10. Bryce, James, Jun., F. G. S., *Glasgow*.
 1863. 11. Burkitt, Robert J., M. D., 5, *Lady-lane, Waterford*.
 1851. 12. Carroll, Isaac, *Cork*.
 1855. 13. Chandlee, Thomas, *Cork*.
 1863. 14. Clarke, Rev. Benjamin, A. M., *Tuam, Galway*.
 1863. 15. Crozier, Captain, R. E., *Gibraltar*.
 1863. 16. Dale, J. C., F. L. S., *Granville, Wootton, Sherborne, Dorset*.
 1865. 17. Delap, Rev. A., *Milford*.
 1863. 18. Dickie, George, M. D., F. L. S., Professor of Botany, *Aberdeen*.
 1860. 19. Divers, Edward, M. D.
 1857. 20. Dixon, Rev. Robert Vickers, D. D., Ex-F. T. C. D., *Clougherney Rectory, Dungannon*.
 1863. 21. Douglas, J. W., 6, *Kingswood Terrace, Lea, Kent*.
 1863. 22. Enniskillen, Right Hon. the Earl of, F. R. S., M. R. I. A., *Florence Court, Enniskillen*.
 1856. 23. Emerson, Rev. J. M., *Ballilinan, Athy*.
 1859. 24. Gage, R. Connolly, *Rathlin Island, Ballycastle*.
 1864. 25. Gahan, Alfred, C. E., *Donegal*.
 1863. 26. Garner, Robert, F. L. S., *Stoke-upon-Trent*.
 1863. 27. Gordon, Rev. George, *The Manse, Birnie, Elgin, N. B.*
 1863. 28. Gosse, Philip Henry, F. R. S., *Sandhurst, Torquay*.
 1863. 29. Greene, Rev. Joseph, *Cubbley Rectory, Doveridge, Derbyshire*.
 1864. 30. Harte, William, C. E., F. R. G. S. I., *Buncrana*.
 1858. 31. Harvey, Rev. Robert, *Leck Glebe, Letterkenny*.
 1841. 32. Hassall, A. H., M. B., *London*.
 1865. 33. Haughton, Captain, R. A., *St. Helena*.
 1863. 34. Higgins, Rev. H., *Liverpool*.
 1863. 35. Hodges, J. F., Professor of Agriculture, *Belfast*.
 1863. 36. Hogan, Rev. A. R., M. A., *Shaftsbury, Dorsetshire*.
 1863. 37. Hooker, J. Dalton, M. D., C. B., F. R. S., F. L. S., F. G. S., *Royal Botanic Gardens, Kew*.
 1863. 38. Humphreys, John, *Cork*.
 1863. 39. Ingham, Captain, J. C., *Athlone*.
 1863. 40. Janson, E. W., *London*.
 1863. 41. Jardine, Sir W., F. R. S., F. L. S., *Jardine Hall, Dumfriesshire*.
 1863. 42. Jeffreys, J. Gwynn, F. R. S., *London*.
 1857. 43. Kennedy, William, *Rathkeale*.
 1857. 44. Kinahan, George Henry, *Geological Survey, Galway*.
 1863. 45. King, W., Professor of Geology, *Queen's College, Galway*.
 1863. 46. Knox, Rev. Thomas, A. M., *Lurgan*.

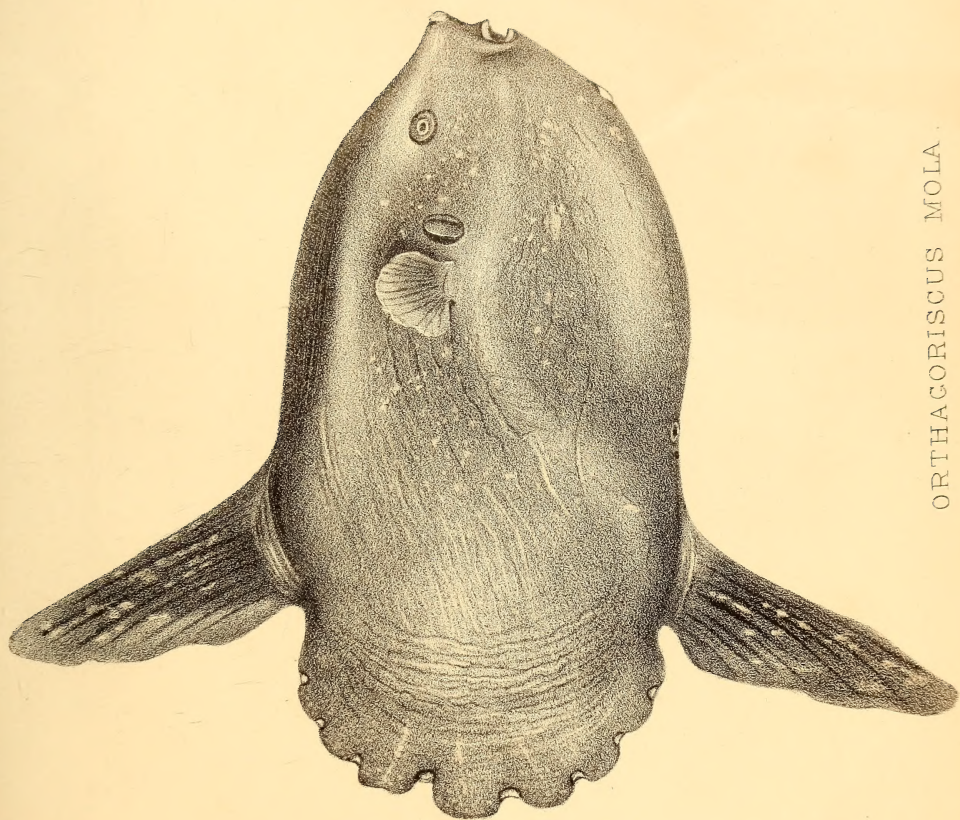
- Elected.
1863. 47. Lankester, Edwin, M. D., LL. D., F. R. S., F. L. S., *Hampstead, London.*
 1863. 48. Lane, P. W., M. D., M. R. C. S. E., *Newtownlimavady.*
 1858. 49. Lawson, Henry, M. D., *London.*
 1863. 50. Lea, John Walter, *The Grange, Shepperton-green, Chertsey, Surrey.*
 1857. 51. Leckey, W., *Valentia Island.*
 1858. 52. Loughran, William, A. L. S., *Polperro.*
 1852. 53. Lowe, Edward J., F. R. A. S., F. L. S., F. G. S., *Nottingham.*
 1863. 54. M'Andrew, Robert, F. R. S., F. L. S., *Islesworth.*
 1863. 55. M'Gee, William, M. D., *Donegall-square, Belfast.*
 1863. 56. Mac Ilwaine, Rev. W., D. D., *Hampton, Belfast.*
 1858. 57. Martin, J., *Portlaw.*
 1861. 58. Mayne, Rev. Charles, A. M., *Killaloe.*
 1863. 59. Meade, R. H., *Bradford, Yorkshire.*
 1863. 60. Melville, Alexander, M. D., Professor of Natural History, *Queen's College, Galway.*
 1865. 61. Murray, J. S., *Milford.*
 1860. 62. Newton, Alfred, M. A., F. R. S., Professor of Natural History, *Cambridge.*
 1860. 63. O'Brien, George, M. D., *Ennis.*
 1857. 64. O'Kelly, Joseph, C. E., *Geological Survey.*
 1863. 65. Ogilby, William, F. R. S., *Lisclean, Dunamanagh.*
 1863. 66. O'Meara, Rev. Eugene, A. M., *Newcastle-Lyons Rectory, Hazelhatch.*
 1858. 67. Palmer, Sandford, *Ballintough, Roscrea.*
 1863. 68. Phillips, John, M. A., LL. D., F. R. S., Professor of Geology, *Oxford.*
 1863. 69. Redfern, P., M. D., Professor of Anatomy, *Queen's College, Belfast.*
 1863. 70. Robinson, Rev. G. T., *Armagh.*
 1860. 71. Roland, J., M. D., *Bangor.*
 1863. 72. Sclater, Philip Lutley, M. A., F. R. S., *Hanover-square, London.*
 1863. 73. Smith, Frederick, *British Museum, London.*
 1863. 74. Stainton, H. T., F. R. S., F. G. S., *Lewisham, Kent.*
 1863. 75. Thomson, Wyville, LL. D., Professor of Natural History, *Queen's College, Belfast.*
 1851. 76. Townsend, Ven. Hamilton, *Collooney.*
 1861. 77. Vize, Rev. John E., *Bath.*
 1863. 78. Waller, Edward, *Lissenderry, Aghnacloy.*
 1859. 79. Warren, Robert, Jun., *Moyview, Ballina.*
 1845. 80. Wilson, Lieut., R. N.
 1863. 81. Wollaston, Thomas Vernon, A. M., F. L. S., *Hereford-street, Park-lane, London.*
 1857. 82. Wynne, A. B., *Geological Survey.*

[Corrections of Errors, or Omissions, will be thankfully received by the Secretaries, addressed, ROYAL IRISH ACADEMY HOUSE, DAWSON-STREET, DUBLIN.]



ORTHAGORISCUS OBLONGUS.





ORTHACORISCUS MOLA.





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